Quality Assurance Project Plan

Lemberger Landfill and Lemberger Transport and Recycling Site
Town of Franklin, Wisconsin

Revision 1
September 2011

TRC

Quality Assurance Project Plan

Lemberger Landfill and Lemberger Transport and Recycling Site
Town of Franklin, Wisconsin

Revision 1
September 2011

Prepared By
TRC Environmental Corporation
Madison, Wisconsin

Table of Contents

List of Figures

List of Attachments

List of Worksheets

Acronyms and Abbreviations

µg/L	micrograms per liter
mg/L	milligrams per liter
mL/min	milliliters per minute
ASTM	American Society for Testing and Materials
BEHP	bis(2-ethylhexyl)phthalate
BOD	biological oxygen demand
CCB	continuing calibration blank
CCC	calibration check compound
CCV	continuing calibration verification
CD	Consent Decree
CLP	Contract Laboratory Program
COC	Chain-of-Custody
CQA	construction quality assurance
CVAA	cold vapor atomic absorption
DI	deionized
DMR	Discharge Monitoring Report
DO	dissolved oxygen
DQI	data quality indicators
DQO	Data Quality Objective
ECD	electron capture detector
EDD	electronic data deliverable
E_H	redox potential
ES	Enforcement Standard
FID	flame ionization detector
FSC	field sampling coordinator
FSP	Field Sampling Plan
GC	gas chromatography
GC/MS	gas chromatograph/mass spectrometer
GEMS	Groundwater Environmental Monitoring System
GIS	geographic information system
GMP	Groundwater Monitoring Plan

GPS	global positioning system
HRMS	high resolution mass spectrometry
HSP	Health and Safety Plan
IC	ion chromatograph
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively coupled plasma
ICS	interface check samples
ICV	initial calibration verification
IDW	investigation-derived waste
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LL	Lemberger Landfill Site
LOD	Limit of Detection
LOQ	Limit of Quantitation
LSRG	Lemberger Site Remediation Group
LTR	Lemberger Transport and Recycling Site
LTMP	Long Term Monitoring Program
MNA	monitored natural attenuation
MS	matrix spike
MS/MSD	matrix spike/matrix spike duplicate
MSD	matrix spike duplicate
NTU	nephelometric turbidity unit
O&M	operation and maintenance
OSC	on-site coordinator
O.U.	operable unit
PAH	polycyclic aromatic hydrocarbons
PAL	Preventive Action Limit
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
pH	negative logarithm (base 10) of hydrogen ion activity
PID	photoionization detector
PM	Project Manager
QA	quality assurance
QA/QC	quality assurance/quality control

QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RF	response factor
ROD	Record of Decision
RPD	relative percent difference
RPM	Remedial Project Manager
RSD	relative standard deviation
RT	retention time
SAP	Sampling and Analysis Plan
SIM	selective ion monitoring
SOP	Standard Operating Procedure
SOW	scope of work
SPCC	system performance check compound
SVOC	semivolatile organic compounds
SW846	Test Methods for Evaluating Solid Waste, 1996
TAL	Target Analyte List
TBD	to be determined
TSS	total suspended solids
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WAC	Wisconsin Administrative Code
WGNHS	Wisconsin Geologic and Natural History Survey
WPDES	Wisconsin Pollutant Discharge Elimination System

Section 1
Introduction

1.1 Background

On June 15, 1992, and May 12, 1993, the Lemberger Site Remediation Group (LSRG) members entered into a Consent Decree (CD) and then an Administrative Order on Consent (AOC), with the U.S. Environmental Protection Agency (USEPA) to undertake certain remedial activities associated with the two Lemberger sites. The two Lemberger sites are the Lemberger Landfill (LL) and the Lemberger Transport and Recycling Site (LTR).

USEPA requires that all environmental monitoring and measurement efforts mandated or supported by USEPA participate in a centrally managed quality assurance program. Any party generating data under this program has the responsibility to implement minimum procedures to ensure that the precision, accuracy, completeness, and representativeness of the data are known and documented. To ensure that this responsibility is met uniformly, a written Quality Assurance Project Plan (QAPP) must be prepared for each project.

The original Quality Assurance Project Plan (QAPP) for the field sampling and analytical testing requirements of the groundwater remedial action and the post-closure care of the Lemberger Landfill (LL) Site and the Lemberger Transport and Recycling (LTR) Site is included (as Appendix E) in the document titled "Final Operation and Maintenance Plan, Lemberger Landfill RD/RA, Operable Unit 1" (the O&M Plan), issued in February 1997 (Malcolm Pirnie, 1997), and approved by the United States Environmental Protection Agency (USEPA). The required sampling and testing for the Lemberger sites has been performed in accordance with the approved O&M Plan, including the QAPP, since startup of the groundwater remediation system in March 1997.

Two addenda to the original 1997 QAPP have been previously requested and approved. The first addendum, submitted in July 2004 (RMT, 2004) (and approved by USEPA on 10 August 2004), authorized changes to certain laboratory reporting formats (data deliverables) and to the analytical methods for metals in aqueous samples. The second addendum, submitted in April 2006 (RMT, 2006a and 2006b) (and approved by USEPA 15 June 2006), authorized modifications to the groundwater monitoring program needed to support the Monitored Natural Attenuation Engineering Demonstration Project, which began in August 2006. These modifications included changes to the purging and sampling methodology (low-flow sampling), and provided analytical methodology for additional natural attenuation monitoring parameters.

In July 2010, the USEPA issued the Third Five-Year Review Report for the Lemberger site (USEPA 2010). In this document, the USEPA states that the current groundwater monitoring program is protective, but needs modification to ensure future protectiveness. Some of those modifications included issues with the laboratory detection limits and data quality. Specifically:

- Method detection limits (MDLs) for polychlorinated biphenyls (PCBs), three chlorinated polyaromatic hydrocarbons (cPAHs), and pentachlorophenol (PCP) are above regulatory standards
- Detections of bis-2 ethylhexyl phthalate (BEHP) are believed to be sampling or laboratory artifacts

Other modifications to the groundwater monitoring program requested by the USEPA include changes to the monitoring network, specifically:

- Additional monitoring in the downgradient plume, and at depth within the plume
- Installation of additional sentinel wells to provide adequate early warning to residential well owners
- A plan for adding new private wells installed within the plume area to the monitoring program

In response to the USEPA's third 5-year report, modifications to the groundwater monitoring and analytical programs were outlined in a revision to the Groundwater Monitoring Plan for the Lemberger Sites (RMT, 2011a), and a third QAPP addendum (RMT, 2010b) was prepared to update the standard operating procedures and Method Detection Limits for analysis of VOCs, SVOCs, PCBs, and metals in support of the modified Groundwater Monitoring Plan.

Upon review of the 2010 QAPP addendum, in a letter dated February 1, 2011, the USEPA required that a new QAPP be prepared for the site (USEPA 2011). This requirement was not based on any identified deficiencies in the existing QAPP documents, other than those recognized and corrected in the addenda cited above. Instead, the requirement was based on EPA's project manager's interpretation and application of USEPA policy, specifically a statement in the Uniform Federal Policy for Quality Assurance Project Plans (USEPA 2005a): "Project-specific and generic QAPPs must be kept current and be revised when necessary when directed by the approval authority, or at least every 5 years." At the time of this review, the existing approved QAPP document was 13 years old; the QAPP was prepared by and for a different contractor (Malcolm Pirnie); sampling, analytical, and data review procedures, staffing, and reporting had not been reviewed or addressed in the QAPP addendum, and historical alterations to the QAPP (covered in QAPP addenda and other work planning

documents) had not been consolidated. In addition, the 2005 QAPP guidance documents change the required structure and content of the QAPP document. Based on this evaluation, the USEPA determined that a complete revision of the QAPP was necessary at this time.

1.2 Development of the QAPP

This QAPP has been prepared as a "generic" QAPP as defined by, and in accordance with the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP), Manual V1, March 2005 (USEPA, 2005a), and the Uniform Federal Policy for Quality Assurance Project Plans, Part 2B, Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities V1, March 2005 (USEPA, 2005b). This QAPP covers the overall Lemberger Site, and also includes project-specific and task-specific details associated with ongoing monitoring programs.

All quality assurance and quality control (QA/QC) procedures performed under this QAPP will be in accordance with applicable professional technical standards, USEPA requirements, other pertinent government regulations and guidelines, and the specific project goals and requirements.

This QAPP presents the objectives, organization, functional activities, and specific QA and QC activities associated with implementing the projects that are described in Section 2. This QAPP also describes the specific protocols that will be followed for sampling of various environmental media, sample handling and storage, chain-of-custody, and laboratory analysis.

1.3 Applicability

This QAPP is applicable for work to be performed by LSRG and its representatives associated with the Lemberger Landfill and Lemberger Transport and Recycling Sites. The work activities will include tasks conducted by LSRG under the Consent Decree, as may be amended or modified. This QAPP will be modified in the future as other sampling programs or projects are identified or defined, *e.g.*, additional worksheets, such as Problem Definition-DQOs (Worksheet #10-1), will be inserted to describe the project sampling objectives and sampling program. This QAPP may also be updated to address additional investigations or remedial actions that may be required under the Consent Decree.

Section 2
Scope of Planned Activities

This section provides a summary of the scope of specific projects and activities at the Lemberger sites that require, or will require, collection and analysis of environmental data and samples. Some of the projects and activities are in the final planning stage, awaiting USEPA's approval of project-specific work plans that have or will be submitted for review and approval. Other required data collection activities that involve sampling and laboratory analyses are specified in the Consent Decree and associated correspondence from USEPA.

2.1 Long Term Monitoring

The CD Scope of Work (SOW) required that a Final Operation and Maintenance Plan (O&M Plan) be prepared and submitted to the USEPA. The purpose of the O&M Plan is to describe post-closure care of the LL and operating and maintenance plans for the groundwater treatment system. The Final O&M plan was submitted to the USEPA in February 1997 (Malcolm Pirnie, 1997).

The O&M Plan defines five monitoring subprograms:

- Groundwater Performance Monitoring
- Treated Effluent Monitoring
- Leachate Monitoring
- Branch River Ecological Monitoring
- Gas Migration Monitoring

The scope of the monitoring subprograms has been modified over the years to reflect changes to the remedial system design and operation schedule. The Branch River Ecological Monitoring program was completed in 2003.

A Groundwater Monitoring Plan (GMP) that presents an updated analytical program for the groundwater monitoring program, as well as site maps showing the complete monitoring well network has been submitted to the USEPA for review concurrently with this QAPP (TRC, 2011a). The treated effluent monitoring, leachate monitoring, and gas migration monitoring programs will continue following the currently approved programs. The combined monitoring subprograms of groundwater performance monitoring, treated effluent monitoring, leachate

monitoring, and gas migration monitoring are herein referred to as the "Long Term Monitoring Program."

This task section focuses on the implementation of the Long Term Monitoring Program as proposed in the GMP (TRC, 2011a), incorporating recommendations from the USEPA's third 5-year review. It sets the monitoring locations, monitoring frequency, and analytical programs for all of the monitoring subprograms described above, and addresses the data quality issues and outdated laboratory reporting limits cited in the third 5-year review. Some of the proposed monitoring well locations referenced in the GMP have yet to be installed and are proposed in response to USEPA and WDNR comments. These modifications may necessitate the installation of new monitoring wells, which will be addressed in the next task section (Subsection 2.2).

Details for implementation of the Long Term Monitoring Program tasks are provided in QAPP Worksheet #10-1. Monitoring locations are shown on Figure 1 through Figure 5.

2.2 Groundwater Monitoring Well Installation

In its third 5-year review, the USEPA states that the current groundwater monitoring program is protective, but needs modification to ensure future protectiveness. The USEPA indicated its belief that chlorinated volatile organic compounds (CVOCs) have migrated "deeper in to bedrock than was expected and may be migrating through a fracture network in the deep bedrock that is not adequately monitored".

TRC (formerly RMT), developed a groundwater monitoring plan (GMP) to define the long term monitoring program for the Lemberger Site, incorporating changes to the monitoring network, monitoring frequency, and analytical programs designed to address USEPA's concerns. The development of the GMP included and evaluation of the protectiveness of the existing monitoring well network (TRC, 2011a). As a result of this evaluation, TRC, on behalf of the LSRG, has proposed the installation of four new monitoring wells:

- A single deep bedrock monitoring well (RM-003XD) proposed adjacent to the existing RM-003I/-003D well nest.
- A three well nest proposed north of the LTR (RM-401D, -XD, -XXD)

The locations and rationale for the proposed additional monitoring wells are defined in the GMP (TRC, 2011a), and the locations are shown on Figures 1 through 6 of this QAPP. This task section focuses on the analytical and sampling methodology associated with the monitoring well installation field work, such as vertical profile water samples collected during drilling;

details regarding monitoring well construction methodology, geologic and geophysical logging, and other non-analytical tasks will be addressed in the SAP (prepared concurrently with this QAPP) (TRC, 2011b).

The details for implementation of the monitoring well installation at the LTR are provided in QAPP Worksheet #10-2.

Section 3
Document Overview

This generic QAPP has been developed in accordance with the Uniform Federal Policy (UFP) QAPP guidance (USEPA, 2005a), which is composed of a series of 37 worksheets, along with a series of attachments. The worksheets provide information on project management, project objectives, measurement and data acquisition, project assessment and oversight, and data review. The attachments include a summary of the Long Term Monitoring program, field Standard Operating Procedures (SOPs), laboratory QC limits, example chain-of-custody records, and laboratory SOPs. In accordance with USEPA guidance, cross-referencing is utilized where applicable, in order to streamline the document, including references to planning documents that are companion documents to this generic QAPP.

Section 4
References

Malcolm Pirnie. 1997. Final operation and maintenance plan, Lemberger Landfill RD/RA Operable Unit 1. February 1997.

RMT. 2004. Addendum to the quality assurance project plan, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. July 2004.

RMT. 2006a. Addendum to the quality assurance project plan for the monitored natural attenuation engineering demonstration project, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. April 2006.

RMT. 2006b. Supplement to the addendum to the quality assurance project plan for the monitored natural attenuation engineering demonstration project, standard operating procedures for analytical methods, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. April 2006.

RMT. 2010b. Addendum to the quality assurance project plan, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. December 2010.

RMT. 2011a. Groundwater monitoring plan, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. Revision 1. April 2011.

TRC. 2011a. Groundwater monitoring plan, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. Revision 2. September 2011.

TRC. 2011b Sampling and analysis plan, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. Revision 1. September 2011.

USEPA. 1991. Record of Decision, Lemberger Landfill, Inc. Lemberger Transport and Recycling, Inc. Manitowoc County, Wisconsin.

USEPA. 2004. USEPA Contract laboratory program. National functional guidelines for inorganic data review. October 2004.

USEPA. 2005a. Uniform federal policy for quality assurance project plans. Evaluating, assessing, and documenting environmental data collection and use programs, Part 1: UFP-QAPP Manual (Version 1). Pub. Nos., EPA: EPA-505-B-04-900A, DoD: DTIC ADA 427785. March 2005.

USEPA. 2005b. Uniform federal policy for quality assurance project plans. Part 2B, quality assurance/quality control compendium: minimum QA/QC activities (Version 1). Pub. Nos., EPA: EPA-505-B-04-900B, DoD: DTIC ADA 426957. March 2005.

USEPA. 2008. U.S. EPA contract laboratory program. National functional guidelines for organic data review. EPA 540-R-08-01. June 2008.

USEPA. 2010. Five year review report, third five year review report for Lemberger Landfill (Lemberger Flyash) Lemberger Transport and Recycling, Franklin Township, Manitowoc County, Wisconsin. July 2010. U.S. Environmental Protection Agency, Region 5. Chicago, IL. July 14, 2010.

USEPA. 2011. Letter to Kristopher Krause, RMT Re. Lemberger Landfill and Lemberger Transport Groundwater Monitoring Plan, and Quality Assurance Project Plan dated February 1, 2011. United States Environmental Protection Agency Region 5, Chicago, IL.

FIGURES

LEGEND

- GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- MONITORING WELL (RM)
- RESIDENTIAL WELL (GR)
- PROPOSED NEW MONITORING LOCATION
- LANDFILL AREA
- TCE PAL PLUME (SEPTEMBER 2010)

NOTES

1. AERIAL IMAGERY FROM MANITOWOC COUNTY, 2010.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. SAMPLED WELLS ARE LABELED WITH THE WELL IDENTIFICATION. ALL OTHER SAMPLING POINTS ARE NOT LABELED.

N

0 1,000 FEET

1 " = 1,000 '

1:12,000

PROJECT:
LEMBERGER SITES
TOWN OF FRANKLIN, WISCONSIN

SHEET TITLE:
QAPP SEMI-ANNUAL GROUNDWATER LEVEL MONITORING LOCATIONS

DRAWN BY:	PAPEZ J	SCALE:	PROJ. NO. 005194-001
CHECKED BY:	O'CONNELL T	AS NOTED	FILE NO. 064290805_SA.mxd
APPROVED BY:	WEDEKIND J	DATE PRINTED:	**FIGURE 1**
DATE:	SEPTEMBER 2011		

TRC
708 Heartland Trail
Madison, WI 53717-1934
Phone: 608-826-3600
Fax: 608-826-3941

E:\RMT_DATA\06429\08\064290805_SA.mxd

LEGEND

- GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- MONITORING WELL (RM)
- RESIDENTIAL WELL (GR)
- PROPOSED NEW MONITORING LOCATION
- LANDFILL AREA
- TCE PAL PLUME (SEPTEMBER 2010)

NOTES

1. AERIAL IMAGERY FROM MANITOWOC COUNTY, 2010.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. SAMPLED WELLS ARE LABELED WITH THE WELL IDENTIFICATION. ALL OTHER SAMPLING POINTS ARE NOT LABELED.

N

0 1,000 FEET

1 " = 1,000 '

1:12,000

PROJECT:
LEMBERGER SITES
TOWN OF FRANKLIN, WISCONSIN

SHEET TITLE:
QAPP QUARTERLY GROUNDWATER QUALITY MONITORING POINTS

DRAWN BY: PAPEZ J	SCALE: AS NOTED	PROJ. NO. 005194-001	
CHECKED BY: O'CONNELL T		FILE NO. 064290806_Q.mxd	
APPROVED BY: WEDEKIND J	DATE PRINTED:	**FIGURE 2**	
DATE: SEPTEMBER 2011			

TRC
708 Heartland Trail
Madison, WI 53717-1934
Phone: 608-826-3600
Fax: 608-826-3941

E:\RMT_DATA\06429\08\064290806_Q.mxd

LEGEND

- GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- MONITORING WELL (RM)
- RESIDENTIAL WELL (GR)
- PROPOSED NEW MONITORING LOCATION
- LANDFILL AREA
- TCE PAL PLUME (SEPTEMBER 2010)

NOTES

1. AERIAL IMAGERY FROM MANITOWOC COUNTY, 2010.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. SAMPLED WELLS ARE LABELED WITH THE WELL IDENTIFICATION. ALL OTHER SAMPLING POINTS ARE NOT LABELED.

N

0 1,000 FEET

1 " = 1,000 '

1:12,000

PROJECT:

LEMBERGER SITES
TOWN OF FRANKLIN, WISCONSIN

SHEET TITLE:

QAPP SEMI-ANNUAL GROUNDWATER QUALITY MONITORING POINTS

DRAWN BY: PAPEZ J	SCALE:	PROJ. NO.	005194-001
CHECKED BY: O'CONNELL T	AS NOTED	FILE NO.	064290807_SA.mxd
APPROVED BY: WEDEKIND J	DATE PRINTED:	**FIGURE 3**	
DATE: SEPTEMBER 2011			

TRC
708 Heartland Trail
Madison, WI 53717-1934
Phone: 608-826-3600
Fax: 608-826-3941

E:\RMT_DATA\06429\08\064290807_SA.mxd

LEGEND

- GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- MONITORING WELL (RM)
- RESIDENTIAL WELL (GR)
- PROPOSED NEW MONITORING LOCATION
- LANDFILL AREA
- TCE PAL PLUME (SEPTEMBER 2010)

NOTES

1. AERIAL IMAGERY FROM MANITOWOC COUNTY, 2010.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. SAMPLED WELLS ARE LABELED WITH THE WELL IDENTIFICATION. ALL OTHER SAMPLING POINTS ARE NOT LABELED.

N

0 1,000 FEET

1 " = 1,000 '

1:12,000

PROJECT:

LEMBERGER SITES
TOWN OF FRANKLIN, WISCONSIN

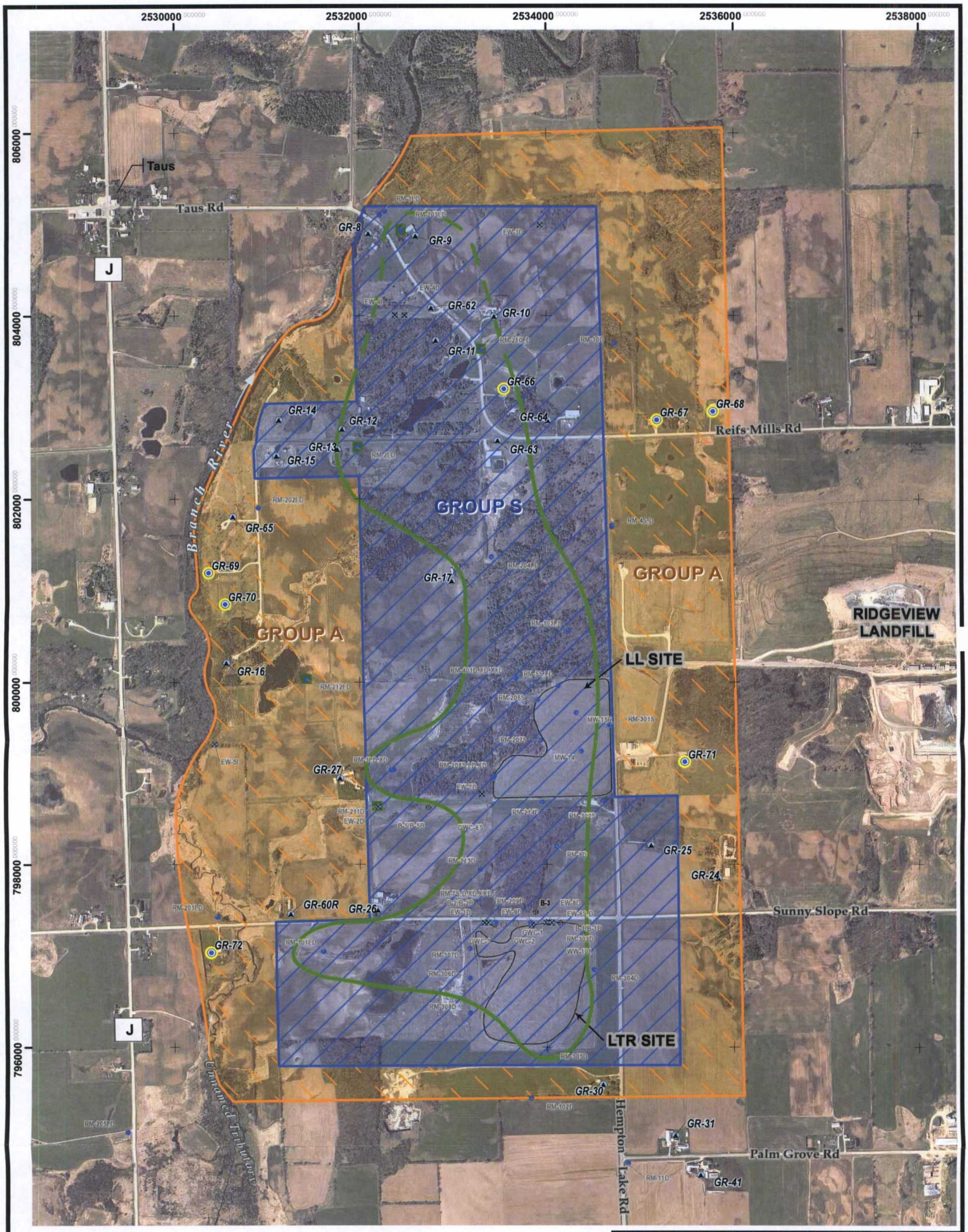
SHEET TITLE:

QAPP ANNUAL GROUNDWATER QUALITY MONITORING POINTS

DRAWN BY:	PAPEZ J	SCALE:	PROJ. NO. 005194-001
CHECKED BY:	O'CONNELL T	AS NOTED	FILE NO. 064290808_A.mxd
APPROVED BY:	WEDEKIND J	DATE PRINTED:	**FIGURE 4**
DATE:	SEPTEMBER 2011		

TRC
708 Heartland Trail
Madison, WI 53717-1934
Phone: 608-826-3600
Fax: 608-826-3941

E:\RMT_DATA\06429\08\064290808_A.mxd



LEGEND

SAMPLE AND MONITORING LOCATIONS

- Bedrock boring
- GW Collection Sump (GWC)
- GW Extraction Well (EW)
- Monitoring Well (RM)
- **Residential Well (GR)**
- SENTINEL WELLS

- TCE PAL PLUME (SEPTEMBER 2010)
- LANDFILL AREA
- KNOWN OR SUSPECTED PRIVATE WELL (NOT IN CURRENT MONITORING PROGRAM)

PRIVATE WELL GROUP AREAS

- GROUP S
- GROUP A

NOTES

1. AERIAL IMAGERY FROM MANITOWOC COUNTY, 2010.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. DATA ARE PROVISIONAL (Q = RESULT IS BETWEEN THE LOD AND LOQ).
4. TCE WAS NOT DETECTED IN RESIDENTIAL WELL SAMPLES DURING THE REPORTING PERIOD; RESIDENTIAL WELL RESULTS ARE NOT USED FOR CONTOURING.

0 1,000 FEET

1 " = 1,000 '

1:12,000

PROJECT:

LEMBERGER SITES
TOWN OF FRANKLIN, WISCONSIN

SHEET TITLE:

QAPP PRIVATE WELL SAMPLING PROGRAM

DRAWN BY:	PAPEZ J	SCALE:		PROJ. NO.	005194-001
CHECKED BY:	O'CONNELL T		AS NOTED	FILE NO.	064290809.mxd
APPROVED BY:	WEDEKIND J	DATE PRINTED:			**FIGURE 5**
DATE:	SEPTEMBER 2011				

TRC

708 Heartland Trail
Madison, WI 53717-1934
Phone: 608-826-3600
Fax: 608-826-3941

E:\RMT_DATA\06429\08\064290809.mxd

LEGEND

SAMPLE AND MONITORING LOCATIONS - JOINED ▭ LANDFILL AREA

- ⊠ GAS PROBE
- ◬ GAS VENT
- ○ GW COLLECTION SUMP (GWC)
- ⊠ GW EXTRACTION WELL (EW)
- ⊙ GW OBSERVATION WELL (OW)
- ● MONITORING WELL (RM)
- ◭ RESIDENTIAL WELL (GR)

NOTES

1. AERIAL IMAGERY FROM MANITOWOC COUNTY, 2010.
2. MAP COORDINATES ARE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. GAS PROBE AND VENT LOCATIONS DIGITIZED FROM 1996 MILLER/TERRA CAD DRAWING.

0 200 FEET

1 " = 200 ' 1:2,400

N

PROJECT: **LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**

SHEET TITLE: **QAPP GAS PROBE AND GAS VENT LOCATIONS**

DRAWN BY:	BENTON K	SCALE: AS NOTED	PROJ. NO. 005197-001
CHECKED BY:	WESTOVER M		FILE NO. 064290802.mxd
APPROVED BY:	WEDEKIND J	DATE PRINTED:	**FIGURE 6**
DATE:	SEPTEMBER 2011		

TRC
708 Heartland Trail
Madison, WI 53717-1934
Phone: 608-826-3600
Fax: 608-826-3941

E:\RMT_DATA\06429\08\064290802.mxd

QAPP Worksheet #1
Title and Approval Page

Site Name/Project Name:	Lemberger Landfill (LL) and Lemberger Transport and Recycling (LTR) Site
Site Location:	The LL and LTR consist of two former land disposal facilities located within one-quarter mile of each other in the Town of Franklin, Manitowoc County, Wisconsin
Document Title:	Quality Assurance Project Plan
Lead Organization:	Lemberger Site Remediation Group
Preparer's Name and Organizational Affiliation:	Kristopher Krause, TRC Environmental Corp.
Preparer's Contact Information:	708 Heartland Trail, Madison, WI 53717, 608-826-3637 kkrause@trcsolutions.com
Preparation Date:	Revision 1 - Final September 2011
Investigative Organization's Project Manager:	Signature: _____ Kristopher Krause, TRC Environmental Corp.
Investigative Organization's Project QA Manager:	Signature: _____ James Wedekind, TRC Environmental Corp.
Lead Organization's Project Manager:	Signature: _____ Kristopher Krause, TRC Environmental Corp.
Regulatory Agency's QAPP Reviewer:	Signature: _____ Warren Layne, Ph.D, USEPA Region 5, Chemist

Document Control Number: Lemberger-001

QAPP Worksheet #2
Identifying Information

Site Name/Project Name:	Lemberger Landfill (LL) and Lemberger Transport and Recycling (LTR) Site
Site Location:	The LL and LTR consist of two former land disposal facilities located within one-quarter mile of each other in the Town of Franklin, Manitowoc County, Wisconsin
Site Number/Code:	USEPA ID: WID980901243 (LL) and WID056247208 (LTR)
Operable Unit:	Operable Unit 1 (Source control at LL and groundwater at LL and LTR)
Contractor's Name:	TRC Environmental Corp (TRC)
Contractor's Number:	(608) 826-3600
Contract Title:	NA
Work Assignment Number:	NA
Identify guidance used to prepare QAPP:	Uniform Federal Policy for Quality Assurance Project Plans, Manual VI (USEPA, 2005a)
Identify regulatory program:	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
Identify approval entity:	USEPA Region 5
Indicate whether the QAPP is a generic or a project-specific QAPP:	This QAPP has been prepared to cover the analytical tasks associated with the Long Term Monitoring Program as defined in the GMP (TRC, 2011a); as well as analytical tasks associated with the installation of additional site groundwater monitoring wells (TRC, 2011b).
List dates of scoping sessions that were held:	See Worksheet #9-1.

QAPP Worksheet #2 (continued)
Identifying Information

List dates and titles of QAPP documents written for previous site work, if applicable:	
Quality Assurance Project Plan, organization partners (stakeholders), and connection with lead organization:	Malcolm Pirnie. 1997. Final Operation and Maintenance Plan, Lemberger Landfill RD/RA Operable Unit 1, prepared for Lemberger Site Remediation Group. February 1997. RMT, Inc. 2004. Addendum to the Quality Assurance Project Plan, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. Revision 2. July 2004. RMT, Inc. 2006a. Addendum to the Quality Assurance Project Plan for the Monitored Natural Attenuation Engineering Demonstration Project, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. Revision 0. April 2006. RMT, Inc. 2006b. Supplement to the Addendum to the Quality Assurance Project Plan for the Monitored Natural Attenuation Engineering Demonstration Project, Standard Operating Procedures for Analytical Methods, Lemberger Landfill and Lemberger Transport and Recycling Site, Town of Franklin, Wisconsin. April 2006.
List data users:	Lemberger Site Remediation Group, Wisconsin Department of Natural Resources (WDNR), USEPA Region 5
Lead Organization's Program Manager:	Douglas Clark, Foley & Lardner

QAPP Worksheet #2 (continued)
Identifying Information

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S) (U.S. EPA, 2006a)	REQUIRED INFORMATION	CROSSWALK TO RELATED INFORMATION AND DOCUMENTS
Project Management and Objectives		
2.1 Title and Approval Page	▪ Title and Approval Page	Worksheet #1, Title and Approval Page
2.2 Document Format and Table of Contents	▪ Table of Contents ▪ QAPP Identifying Information	The Table of Contents is provided following the QAPP cover page. Worksheet #2, Identifying Information
2.2.1 Document Control Format		
2.2.2 Document Control Numbering System		
2.2.3 Table of Contents		
2.2.4 QAPP Identifying Information		
2.3 Distribution List and Project Personnel Sign-Off Sheet	▪ Distribution List ▪ Project Personnel Sign-Off Sheet	Worksheet #3, Distribution List; and Worksheets #4-1 and 4-2, Project Personnel Sign-Off Sheet
2.3.1 Distribution List		
2.3.2 Project Personnel Sign-Off Sheet		
2.4 Project Organization	▪ Project Organizational Chart ▪ Communication Pathways ▪ Personnel Responsibilities and Qualifications Table ▪ Special Personnel Training Requirements Table	Worksheet #5, Project Organization Chart; Worksheet #6, Communication Pathways; Worksheet #7, Personnel Responsibilities and Qualifications; and Worksheet #8, Special Personnel Training Requirements
2.4.1 Project Organization Chart		
2.4.2 Communication Pathways		
2.4.3 Personnel Responsibilities and Qualifications		
2.4.4 Special Training Requirements and Certification		

QAPP Worksheet #2 (continued)
Identifying Information

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S) (U.S. EPA, 2005a)	REQUIRED INFORMATION	CROSSWALK TO RELATED INFORMATION AND DOCUMENTS
Project Management and Objectives (continued)		
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	▪ Project Planning Session ▪ Documentation (including Data Needs tables) ▪ Project Scoping Session Participants Sheet ▪ Problem Definition, Site History, and Background ▪ Site Maps (historical and current)	Worksheet #9, Project Scoping Session Participants Sheet; and Worksheets #10-1 through #10-2, Problem Definition-DQOs Site history and more detail concerning the project DQOs can be found in the companion documents to this QAPP.
2.6 Project Quality Objectives and measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement performance Criteria	▪ Site-Specific Project Quality Objectives (PQOs) ▪ Measurement Performance Criteria Table	Worksheets #11-1 through #11-2, Project Quality Objectives/Systematic Planning Process Statements; Worksheets #12-1 through #12-15, Measurement Performance Criteria
2.7 Secondary Data Evaluation	▪ Sources of Secondary Data and Information ▪ Secondary Data Criteria and Limitations Table	Worksheet #13, Secondary Data Criteria and Limitations
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	▪ Summary of Project Tasks ▪ Reference Limits and Evaluation Table ▪ Project Schedule/Timeline Table	Worksheet #14, Summary of Project Tasks; Worksheets #15-1 through #15-7, Reference Limits and Evaluation; and Worksheets #16-1 through 16-2, Project Schedules/Timelines

QAPP Worksheet #2 (continued)
Identifying Information

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S) (U.S. EPA, 2005a)	REQUIRED INFORMATION	CROSSWALK TO RELATED INFORMATION AND DOCUMENTS
Measurement/Data Acquisition		
3.1 Sampling Tasks	▪ Sampling Design and Rationale ▪ Sample Location Map ▪ Sampling Locations and Methods/ SOP Requirements Table ▪ Analytical Methods/SOP Requirements Table ▪ Field Quality Control Sample Summary Table ▪ Sampling SOPs ▪ Project Sampling SOP References Table ▪ Field Equipment Calibration, Maintenance, Testing, and Inspection Table	Worksheet #17-1 through #17-2, Sampling Design and Rationale; Worksheets #18-1 through #18-2, Sampling Locations and Methods/SOP Requirements; Worksheet #19, Analytical SOP Requirements (sample containers, preservation, and holding times); Worksheet #20, Field Quality Control Sample Summary Worksheet #21, Project Sampling SOP Reference; and Worksheet #22, Field Equipment Calibration, Maintenance, Testing, and Inspection The laboratory SOPs can be found in Attachment 4. More details concerning the sampling design and rationale and the field sampling procedures can be found in the companion documents to this QAPP.
3.1.1 Sampling Process Design and Rationale		
3.1.2 Sampling Procedures and Requirements		
3.1.2.1 Sampling Collection Procedures		
3.1.2.2 Sample Containers, Volume, and Preservation		
3.1.2.3 Equipment/Sample Container Cleaning and Decontamination Procedures		
3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures		
3.1.2.5 Supply Inspection and Acceptance Procedures		
3.1.2.6 Field Documentation Procedures		

QAPP Worksheet #2 (continued)
Identifying Information

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S) (U.S. EPA, 2005a)	REQUIRED INFORMATION	CROSSWALK TO RELATED INFORMATION AND DOCUMENTS
Measurement/Data Acquisition (continued)		
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	▪ Analytical SOPs ▪ Analytical SOP References Table ▪ Analytical Instrument Calibration Table ▪ Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Worksheet #23, Analytical SOP References; Worksheet #24, Analytical Instrument Calibration; and Worksheet #25, Analytical Instrument and Equipment Maintenance, Testing, and Inspection The laboratory SOPs can be found in Attachment 4.
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	▪ Sample Collection Documentation Handling, Tracking, and Custody SOPs ▪ Sample Container Identification ▪ Sample Handling Flow Diagram ▪ Example Chain-of-Custody Record and Seal	Worksheet #27, Sample Custody Requirements More details concerning the field sampling procedures can be found in the companion documents to this QAPP. Example COC forms can be found in Attachment 4.
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	▪ QC Samples Table ▪ Screening/Confirmatory Analysis Decision Tree	Worksheets #28-1 through #28-13, Present QC sample information for project analysis

QAPP Worksheet #2 (continued)
Identifying Information

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S) (U.S. EPA, 2005a)	REQUIRED INFORMATION	CROSSWALK TO RELATED INFORMATION AND DOCUMENTS
Measurement/Data Acquisition (continued)		
3.5 Data Management Tasks	▪ Project Documents and Records Table ▪ Analytical Services Table ▪ Data Management SOPs	Worksheet #29, Project Documents and Records, and Worksheet #30, Analytical Services
3.5.1 Project Documentation and Records		
3.5.2 Data Package Deliverables		
3.5.3 Data Reporting Formats		
3.5.4 Data Handling and Management		
3.5.5 Data Tracking and Control		
4.1 Assessments and Response Actions	▪ Assessments and Response Actions ▪ Planned Project Assessments Table ▪ Audit Checklists ▪ Assessment Findings and Corrective Action Responses Table	Worksheets #31-1 through #31-2, Planned Project Assessments, and Worksheets #32-1 through #32-2, Assessment Findings and Corrective Action Responses The laboratory Quality Assurance Manual and Laboratory Policies and Guidelines documents can be found in Attachment 3.
4.1.1 Planned Assessments		
4.1.2 Assessment Findings and Corrective Action Responses		
4.2 QA Management Reports	▪ QA Management Reports Table	Worksheet #33, QA Management Reports
4.3 Final Project Report		

QAPP Worksheet #2 (continued)
Identifying Information

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S) (U.S. EPA, 2005a)	REQUIRED INFORMATION	CROSSWALK TO RELATED INFORMATION AND DOCUMENTS
Data Review		
5.1 Overview		
5.2 Data Review Steps	▪ Verification (Step I) Process Table ▪ Validation (Steps IIa and IIb) Process Table ▪ Validation (Steps IIa and IIb) Summary Table ▪ Usability Assessment	Worksheet #34, Verification (Step 1) Process; Worksheet #35, Validation (Step I) Process; Worksheet #36, Validation (Steps IIa and IIb) Summary; and Worksheet #37, Usability Assessment.
5.2.1 Step I: Verification		
5.2.2 Step II: Validation		
5.2.2.1 Step IIa Validation Activities		
5.2.2.2 Step IIb Validation Activities		
5.2.3 Step III: Usability Assessment		
5.2.3.1 Data Limitations and Actions from Usability Assessment		
5.2.3.2 Activities		
5.3 Streamlining Data Review	▪ None	NA
5.3.1 Data Review Steps To Be Streamlined		
5.3.2 Criteria for Streamlining Data Review		
5.3.3 Amounts and Types of Data Appropriate for Streamlining		

QAPP Worksheet #3
Distribution List

QAPP RECIPIENTS	TITLE	ORGANIZATION	TELEPHONE NUMBER	E-MAIL ADDRESS	DOCUMENT CONTROL NUMBER
Richard Boice	Remedial Project Manager	USEPA, Region 5	312-886-4740	boice.richard@epamail.epa.gov	Lemberger-001
Annette Weissbach	Hydrogeologist	Wisconsin DNR	920-662-5165	annette.weissbach@wisconsin.gov	Lemberger-001
Gary Edelstein	Waste Management Engineer	Wisconsin DNR	608-267-7563	gary.edelstein@wisconsin.gov	Lemberger-001
Kristopher Krause	Project Manager	TRC	608-826-3637	kkrause@trcsolutions.com	Lemberger-001
James Wedekind	QA Manager	TRC	608-826-3666	jwedekind@trcsolutions.com	Lemberger-001
John Rice	Senior Hydrologist	TRC	608-826-3655	jrice@trcsolutions.com	Lemberger-001
Meredith Westover	Database Manager	TRC	608-826-3667	mwestover@trcsolutions.com	Lemberger-001
Tom Stolzenburg	Data QA Manager	TRC	608-826-3661	tstolzenburg@trcsolutions.com	Lemberger-001

QAPP Worksheet #3 (continued)
Distribution List

QAPP RECIPIENTS	TITLE	ORGANIZATION	TELEPHONE NUMBER	E-MAIL ADDRESS	DOCUMENT CONTROL NUMBER
Brian Basten	Project Manager	Pace Analytical	920-321-9411	brian.basten@pacelabs.com	Lemberger-001
Mark Brooks	LSRG Site Manager	TRC	920-732-3234	mbrooks@trcsolutions.com	Lemberger-001
Field Staff	Staff Scientists	TRC	608-826-3600	Various	Lemberger-001

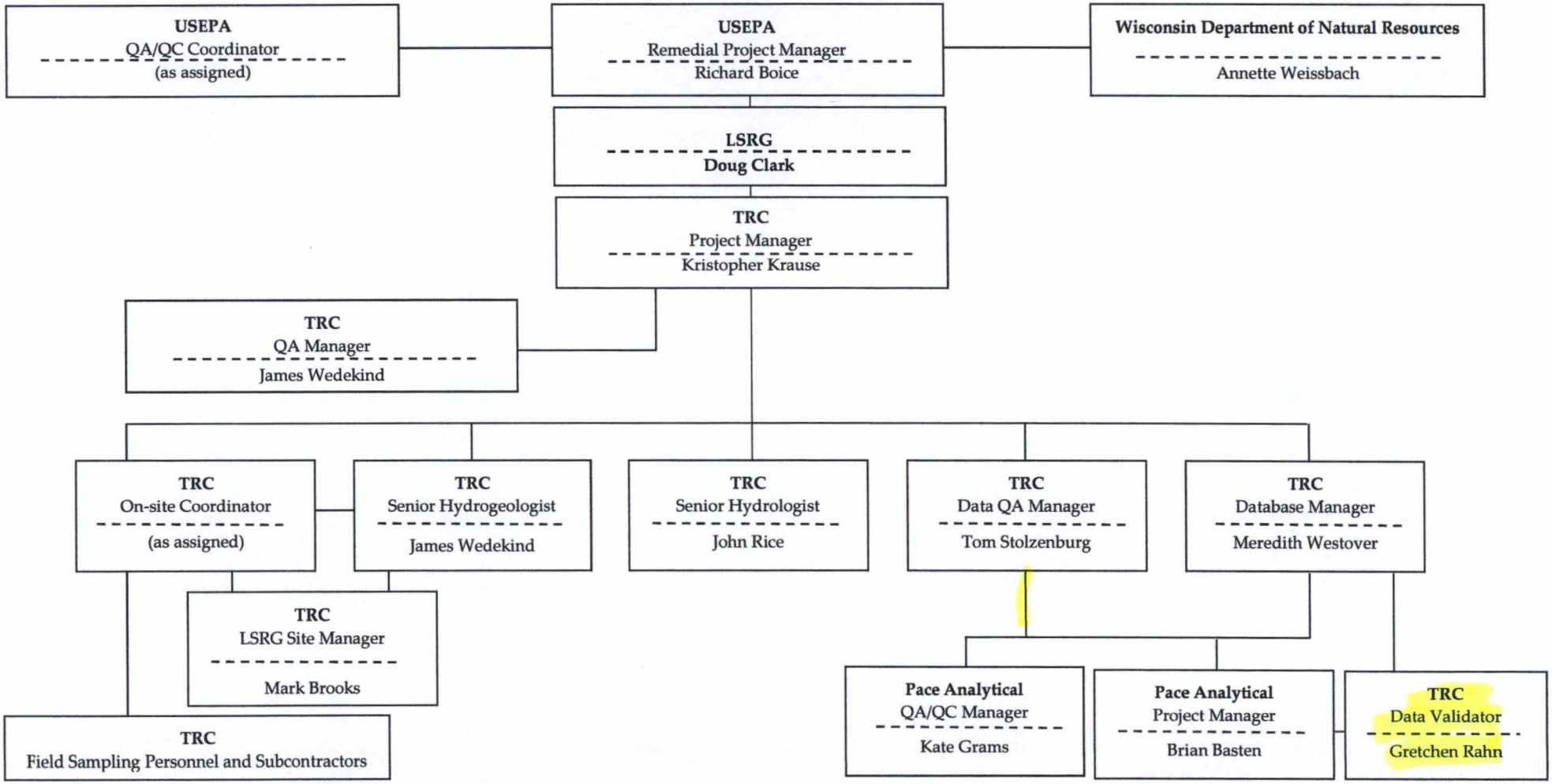
QAPP Worksheet #4-1
Project Personnel Sign-Off Sheet (TRC)

PROJECT PERSONNEL	TITLE	TELEPHONE NUMBER	SIGNATURE	DATE QAPP READ
Kristopher Krause	Project Manager	608-826-3637		
James Wedekind	QA Manager	608-826-3666		
John Rice	Senior Hydrologist	608-826-3655		
(to be assigned)	On-site Coordinator and Health and Safety Representative	--		
Tom Stolzenburg	Data QA Manager	608-826-3661		
Meredith Westover	Database Manager	608-826-3667		
Mark Brooks	LSRG Site Manager	920-732-3234		

QAPP Worksheet #4-2
Project Personnel Sign-Off Sheet (Pace Analytical Laboratories)

PROJECT PERSONNEL	TITLE	TELEPHONE NUMBER	SIGNATURE	DATE QAPP READ
Nils Melberg	Laboratory Manager	920-469-2436		
Brian Basten	Project Manager	920-321-9411		
Kate Grams	QA/QC Manager	920-469-2436		
Jeff Bushner	Volatiles Supervisor	920-469-2436		
Chad Rusch	Metals/Wet Chemistry Supervisor	920-469-2436		
Chris Haase	Semi-Volatiles Supervisor	920-469-2436		

QAPP Worksheet #5
Project Organizational Chart



QAPP Worksheet #6
Communication Pathways

COMMUNICATION DRIVERS	RESPONSIBLE ENTITY	NAME	TELEPHONE NUMBER	PROCEDURE (timing, pathways, etc.)
Manage project technical work	Project Manager	Kristopher Krause, TRC	608-826-3637	Normal day-to-day project communications between the LSRG and other parties, including the USEPA RPM, and performance of technical work and production of technical documents will be managed by Kristopher Krause.
Coordinate field program	On-site Coordinator (OSC) and Health and Safety Officer	(to be assigned)	--	The OSC will provide the TRC Project Manager with an update of field sampling activities, including related questions or problems, by telephone or e-mail at the end of each field work day. The OSC will also report any QQ/QC problems related to field measurements to the Data QA Manager by telephone or e-mail by the end of the same business day.
Provide daily progress reports - field sampling	On-site Coordinator (OSC) and Health and Safety Officer	(to be assigned)	--	The OSC will provide the TRC Project Manager with written daily progress reports, including field records, sampling logs, Chain-of-Custody Records, and any other pertinent information by e-mail or fax within 2 business days.
Notify the Project Manager and the Data QA Manager of any QAPP deviations in the field	On-site Coordinator (OSC) and Health and Safety Officer	(to be assigned)	--	The OSC will immediately notify the TRC Project Manager and the Data QA Manager of any deviations from the QAPP or other approved planning documents (e.g. SAP, FSP, HSP, or RD/RA workplan), including the reasons, by telephone or e-mail.

QAPP Worksheet #6 (continued)
Communication Pathways

COMMUNICATION DRIVERS	RESPONSIBLE ENTITY	NAME	TELEPHONE NUMBER	PROCEDURE (timing, pathways, etc.)
Notify the USEPA and WDNR of any QAPP deviations	Project Manager	Kristopher Krause, TRC	608-826-3637	The TRC Project Manager will immediately report all substantial deviations from the QAPP or associated planning documents (e.g. SAP, FSP, HSP, or RD/RA Workplan) or data quality problems to the USEPA and WDNR by e-mail. The Project Manager will report all deviations from the QAPP or associated planning documents and data quality problems to USEPA and WDNR in quarterly or annual reports.
Reporting lab data quality issues	Laboratory Project Manager	Brian Basten, Pace Laboratories	920-321-9411	The Laboratory Project Manager will notify the Data QA Manager of any QA/QC issues within 1 business day.
	Data QA Manager	Tom Stolzenburg, TRC	608-826-3661	The Data QA Manager reports significant laboratory QA/QC issues that the laboratory cannot, or will not routinely correct to the Project Manager.
Field and analytical corrective actions	Data QA Manager	Tom Stolzenburg, TRC	608-826-3661	The Data QA Manager will recommend the need for corrective action for analytical issues, in conjunction with the Project Manager, the On-site Coordinator, and the USEPA RPM and Laboratory Project Manager, as appropriate.
	Project Manager	Kristopher Krause, TRC	608-826-3637	The TRC Project Manager has the authority to authorize TRC staff, subcontractors, and the Laboratory Project Manager to implement corrective actions provided for in the QAPP and associated planning documents.

QAPP Worksheet #6 (continued)
Communication Pathways

COMMUNICATION DRIVERS	RESPONSIBLE ENTITY	NAME	TELEPHONE NUMBER	PROCEDURE (timing, pathways, etc.)
Field and analytical corrective actions (continued)	Project Manager and Data QA Manager	Kristopher Krause, TRC Tom Stolzenburg, TRC	608-826-3637 608-826-3661	When necessary, the TRC Project Manager and Data QA Manager, in consultation with USEPA staff, WDNR staff, and TRC specialists, will develop corrective actions for field procedures, which may include changes to the QAPP or associated planning documents. TRC must record the proposed changes in writing and submit them to USEPA and WDNR for approval. When necessary, the TRC Project Manager and Data QA Manager, in consultation with USEPA staff, WDNR staff, and Laboratory staff, and TRC specialists, will develop corrective actions for laboratory analytical procedures, which may include changes to the QAPP or associated planning documents. TRC must record the proposed changes in writing and submit them to USEPA and WDNR for approval.
Release of final analytical data	Data QA Manager	Tom Stolzenburg, TRC	608-826-3661	No final analytical data can be released until validation is complete and the Data Manager has approved the release.
	Pace QA/QC Manager	Kate Grams	920-469-2436	The Pace QA/QC Manager will communicate directly to USEPA and WDNR by incorporating the case narrative in the quarterly laboratory reports.
	Data Validator	Gretchen Rahn, TRC	608-335-4166	The TRC Data Validator will communicate directly to USEPA and WDNR by incorporating data validation reports in the quarterly data transmittals.
QAPP amendments	Data QA Manager	Tom Stolzenburg, TRC	608-826-3661	The QAPP will be reviewed every 5 years, or as new scope items are defined. Any major changes to the QAPP must be approved by the Data QA Manager, the Project Manager, and the USEPA before the changes can be implemented.

QAPP Worksheet #7
Personnel Responsibilities and Qualifications

NAME	PROJECT ROLE	ORGANIZATIONAL AFFILIATION	EDUCATION AND EXPERIENCE QUALIFICATIONS
Brian Basten	Laboratory Project Manager	Pace Analytical	University of Wisconsin – Green Bay, 1993 14 years of laboratory experience
Kate Grams	Laboratory QA/QC Manager	Pace Analytical	B.S., Soil Science, University of Wisconsin – Stevens Point, 2000 10 years of laboratory experience
Kristopher Krause	Project Manager	TRC	M.S., Agricultural Engineering, University of Wisconsin - Madison, 1985 B.S., Agricultural Engineering, University of Wisconsin - Madison, 1983 over 25 years experience
Tom Stolzenburg, Ph.D.	Data QA Manager	TRC	Ph.D., Civil and Environmental Engineering, Water Chemistry Program, University of Wisconsin - Madison, 1979 B.S., Resource Management and Biology, UW-Stevens Point, 1974 over 29 years experience
James Wedekind	QA Manager	TRC	M.S., Geology, University of Tennessee - Knoxville, 1986 B.A., Biology, University of Tennessee - Knoxville, 1981 over 25 years experience
John Rice	Senior Hydrologist	TRC	M.S., Civil and Environmental Engineering, University of Wisconsin - Madison, 1984 B.S., Civil and Environmental Engineering, University of Wisconsin - Madison, 1982 Over 25 years experience
Meredith Westover	Database Manager	TRC	M.S., Geology, University of Wisconsin, Madison, 1994 B.S., Geology, University of California, Davis, 1992 over 15 years experience
Mark Brooks	LSRG Site Manager	TRC	Metal Fabrication Welding, Fox Valley Technical College, Appleton, Wisconsin over 14 years experience
(to be assigned)	On-site Coordinator and Health and Safety Representative	TRC	[to be provided after assignment made]

QAPP Worksheet #7 (continued)
Personnel Responsibilities and Qualifications

TRC

Project Manager

- Serve as the primary point-of-contact for TRC.
- Establish and communicate project milestones and schedules.
- Coordinate and review TRC work products.
- Direct TRC team members.

QA Manager

- Provide overall quality assurance, including a review of TRC's performance on the project.
- Review project progress and TRC work products for compliance with project objectives and requirements.

On-site Coordinator and Health and Safety Representative

- Coordinate field staff who will be measuring and recording field parameters, collecting samples, and documenting activities, to ensure compliance with the QAPP and associated planning documents.
- Order sample bottles from the laboratory.
- Prepare reports pertaining to relevant field activities.
- Maintain field and laboratory files, including project documentation, sample logs, and calculations; and provide complete copies to the TRC Project Manager.
- Provide on-site health and safety orientation to all TRC staff and subcontractors, and monitor site activities for compliance with the project Health and Safety Plan.
- Conduct field audits as necessary.

QAPP Worksheet #7 (continued)
Personnel Responsibilities and Qualifications

LSRG Site Manager

- Perform routine observation and monitoring tasks, conduct routine sampling, assist on-site personnel with additional monitoring tasks.
- Assist the On-site Coordinator with Health and Safety orientations for site activities.
- Maintain field records related to site activities, and provide complete copies to the TRC Project Manager.

Senior Hydrologist

- Provide technical input during the planning, design, and implementation stages of the project.
- Review the technical aspects of TRC's submittals.
- Provide senior technical support to the On-site Coordinator for questions or problems that may arise during field work.

Data QA Manager

- Serve as the primary point-of-contact with the laboratory on matters involving data deliverables.
- Coordinate field QA/QC procedures with the On-site Coordinator (*e.g.*, calibrations for field analytical measurements and field audits, as necessary), and review pertinent field records for compliance with the QAPP.
- Review laboratory QA/QC procedures and documentation, as provided in data deliverables.
- Review data for compliance with the Data Quality Objectives (DQOs) for the project.
- Oversee data validation activities and preparation of QA/QC reports by the data validator.

Database Manager

- Establish and maintain a project database.
- Import electronic data deliverables (EDDs) provided by the laboratory into the project database.
- Perform a QA/QC check of imported data versus the hard copy data.
- Transcribe field and non-EDD laboratory data into the project database, as necessary.
- Tabulate data for end users.

QAPP Worksheet #7 (continued)
Personnel Responsibilities and Qualifications

ANALYTICAL LABORATORY

Laboratory QA/QC Manager

- Verify that the laboratory meets the QA/QC standards specified in the QAPP.
- Supervise in-house chain-of-custody.
- Perform laboratory audits, in accordance with the QAPP.

Laboratory Project Manager

- Serve as the primary point-of-contact for the laboratory.
- Oversee preparation of analytical reports.

QAPP Worksheet #8
Special Personnel Training Requirements

PROJECT FUNCTION	SPECIALIZED TRAINING - TITLE OR DESCRIPTION OF COURSE	TRAINING PROVIDER	TRAINING DATE	PERSONNEL/ GROUPS RECEIVING TRAINING	PERSONNEL TITLES/ ORGANIZATIONAL AFFILIATION	LOCATION OF TRAINING RECORDS/ CERTIFICATES
Field activities	▪ 40-hour HAZWOPER and 8-hour HAZWOPER refresher ▪ Degree in geology, soil science, engineering, or related field	▪ Certified HAZWOPER training professionals ▪ Accredited college, university, or equivalent	▪ 8-hour refresher within previous year ▪ Various	Field personnel	TRC personnel	TRC project offices
Analytical chemistry	▪ Pace Analytical (Green Bay) is registered and certified in the state of WI WI Cert # 405132750	N/A	N/A	N/A	Pace Analytical – Green Bay 1241 Bellevue Street, Suite 9 Green Bay, WI 54302 Brian Basten 920-321-9411	N/A

QAPP Worksheet #9-1
Project Scoping Session Participants Sheet

Extensive environmental investigations and remedial actions have been performed at the Lemberger Landfill and Lemberger Transport and Recycling site in accordance with USEPA-approved QAPPs and other planning and design documents over the last two decades. Additional projects involving collection of environmental data are in various stages of planning, preparation, and approval by USEPA.

This QAPP is a comprehensive updating of the previous QAPP and associated addenda that were approved by USEPA for the Lemberger Landfill Sites. It has been prepared in accordance with USEPA's current (2005) QAPP guidance, and supersedes all previous QAPP and QAPP addenda. The scope of this QAPP includes project-specific or task-specific details associated with Long Term Monitoring and an upcoming Groundwater Containment Assessment. Therefore, because the scope, format, and required contents for this update of the QAPP are well defined, a QAPP/project scoping meeting at USEPA's office has not been held or scheduled. However, a conference call with representatives of USEPA could be arranged, if requested, to provide further information regarding the site or past and planned data collection and remediation activities, or to respond to questions regarding this QAPP.

QAPP Worksheet #10-1
Problem Definition - DQOs
(Long Term Monitoring)

Step 1: State the problem.

The O&M Plan for the Lemberger Sites (Malcolm Pirnie, 1997) defines five monitoring subprograms:

- Groundwater Performance Monitoring
- Treated Effluent Monitoring
- Leachate Monitoring
- Branch River Ecological Monitoring
- Gas Migration Monitoring

Despite the implementation of the ROD selected pump and treat remedy over the last 16 years, chlorinated VOCs at concentrations above regulatory standards persist in a groundwater plume extending downgradient of the Lemberger Sites. As a result, observation and monitoring of the groundwater monitoring network, the treatment system effluent, leachate, and gas venting systems at the site is ongoing. The scope of each of the monitoring programs has been altered over the years to reflect changes to the remediation system design and operation schedule; the Branch River Ecological Monitoring Program was completed in 2003. This portion of the QAPP addresses the ongoing Long Term Monitoring Programs.

Step 2: Identify the goal of the study.

- The objectives of the Long Term Monitoring Program are to insure protection of human health and the environment, to assess the threat of future releases to groundwater, to monitor the pace of groundwater cleanup and natural attenuation, and evaluate compliance with effluent discharge limits and leachate disposal limits.

QAPP Worksheet #10-1 (continued)
Problem Definition - DQOs
(Long Term Monitoring)

Step 3: Identify information inputs.

- **Groundwater Performance Monitoring**

  Information inputs will include the results from analysis of samples collected from Plume Monitoring Wells, Sentinel Monitoring Wells, LL Wells, and Residential Wells in accordance with the analytical program outlined in Attachment 1. Sampling locations are shown on Figures 1 through 5.

- **Treated Effluent Monitoring**

  Information inputs will include the results from analysis of samples collected from the treatment system effluent in accordance with the analytical program outlined in Attachment 1. The analytical lists defined for the treated effluent monitoring are modified from the TALs (Worksheets 15-1 through 15-7) and are reflective of the currently approved monitoring program under the Wisconsin Pollutant Discharge Elimination System (WPDES).

- **Leachate Monitoring**

  Information inputs will include the results from analysis of samples collected from the leachate collection tank, and existing site leachate head (LH) and leachate extraction (LW) wells. The leachate samples from the collection tank will be analyzed in accordance with the analytical program outlined in Attachment 1. Sampling of the leachate head wells and extraction wells will be performed periodically, as required by the USEPA.

- **Gas Migration Monitoring**

  Information inputs include field analysis of methane, oxygen, and barometric pressure, in accordance with the analytical program outlined in Attachment 1. Sampling locations are shown on Figure 6.

Step 4: Define the boundaries of the sampling.

- **Groundwater Performance Monitoring**

  The sampling boundary includes the existing monitoring well and residential well network at the LL and LTR

- **Treated Effluent Monitoring**

  The sampling boundary includes the existing extraction well network at the LL and LTR.

- **Leachate Monitoring**

  The sampling boundary includes the LL and the inflow to the leachate collection tanks.

- **Gas Migration Monitoring**

  The sampling boundary includes the existing gas vent and gas probe network at the LL.

QAPP Worksheet #10-1 (continued)
Problem Definition - DQOs
(Long Term Monitoring)

Step 5: Develop the analytical approach.

- Groundwater Monitoring – Groundwater data will be evaluated in an annual Observation and Monitoring (O&M) Progress Report. The analytical approach is described in detail in Section 3 of the GMP (TRC, 2011a).
- Treated Effluent Monitoring – Effluent monitoring data will be evaluated in an annual Observation and Monitoring (O&M) Progress Report. The analytical approach is described in detail in Section 3 of the GMP (TRC, 2011a).
- Leachate Monitoring – Leachate monitoring data will be evaluated in an annual Observation and Monitoring (O&M) Progress Report. The analytical approach is described in detail in Section 3 of the GMP (TRC, 2011a).
- Gas Migration Monitoring – Gas migration monitoring data will be evaluated in an annual Observation and Monitoring (O&M) Progress Report. The analytical approach is described in detail in Section 3 of the GMP (TRC, 2011a).

Step 6: Specify performance or acceptance criteria.

Data collected under this monitoring program must be of sufficient quality for a comparison to groundwater standards and previous data. The consequences of a false acceptance or rejection error is quite low, since no large decision would rest on any one sample, and questionable results can be confirmed with additional samples. However, USEPA approved methods will be followed for sample analysis. The acceptance criteria for these activities is having collected sufficient data and observations to meet the objectives in Step 2 above. In addition, the collected data must meet the appropriate analytical QA/QC requirements to be considered valid (e.g. Worksheets 12, 15, 19-28, 31-37).

Step 7: Develop the plan for obtaining the data.

Specific procedures for sampling, chain of custody, instrument calibration, analysis, reporting, and internal quality control are described in other worksheets of this QAPP.

QAPP Worksheet #10-2
Problem Definition - DQOs
(Groundwater Monitoring Well Installation)

Step 1: State the problem.
TRC has developed a groundwater monitoring plan (GMP) to define the long term monitoring program (LTMP) for the Lemberger Site (TRC, 2011a). Task Section 1 of this QAPP (Worksheet 10-1) outlines the details of the proposed LTMP. The proposed LTMP incorporates changes to the existing monitoring well network, monitoring frequency, and analytical programs designed to address concerns about the protectiveness of the existing monitoring network and analytical program that were raised by the USEPA during its third 5-year review. The proposed LTMP requires the installation of new monitoring wells. The wells will be installed in accordance with the project specific SAP (TRC, 2011b). This task section (Worksheet 10-2) addresses the analytical program associated with the installation of new monitoring wells at the Lemberger Sites.
Step 2: Identify the goal of the study.
The proposed monitoring well installation field work is intended to ensure the future protectiveness of the monitoring network. Specifically, the proposed wells meet the following objectives: ▪ To provide additional monitoring points to further evaluate the downgradient plume, and the plume at depth ▪ To provide adequate early warning to residential wells. The proposed well locations and rationale are discussed in detail in the GMP (TRC, 2011a).
Step 3: Identify information inputs.
Information inputs include the following: ▪ Visual observation and description of unconsolidated soil samples and bedrock cores collected during the installation of new monitoring wells ▪ Analysis of groundwater samples collected from discrete vertical intervals within the boreholes during drilling ▪ Installation of new monitoring wells ▪ Evaluation of a downhole geophysical survey of each new monitoring well/well nest location (performed by the Wisconsin Geologic and Natural History Survey [WGNHS])

QAPP Worksheet #10-2 (continued)
Problem Definition - DQOs
(Groundwater Monitoring Well Installation)

Step 4: Define the boundaries of the sampling.
The well installations will be conducted at the LTR Operable Unit.
Step 5: Develop the Analytical Approach
▪ All physical and analytical data collected during the monitoring well installation will be evaluated in an annual Observation and Monitoring (O&M) Progress Report. The analytical approach is described in detail in Section 3 of the GMP (TRC, 2011a).
Step 6: Specify performance or acceptance criteria.
Data collected under this monitoring program must be of sufficient quality for a comparison to groundwater standards and previous data. USEPA approved methods will be followed for sample analysis. The acceptance criteria for these activities is having collected sufficient data and observations to meet the objectives in Step 2 above. In addition, the collected data must meet the appropriate analytical QA/QC requirements to be considered valid (e.g. Worksheets 12, 15, 19-28, 31-37).
Step 7: Develop the plan for obtaining the data.
Specific procedures for sampling, chain of custody, instrument calibration, analysis, reporting, and internal quality control are described in other worksheets of this QAPP, and are described in the Sampling and Analysis Plan (TRC, 2011b).

QAPP Worksheet #11-1
Project Quality Objectives/Systematic Planning Process Statements
(Long Term Monitoring)

Who will use the data?

LSRG; TRC; USEPA; WDNR.

What will the data be used for?

- **Groundwater Samples:**

  The water quality monitoring data will be used for the following purposes:

  - To further characterize the groundwater flow system and contaminant distribution deeper in bedrock, in order to better assess the threat to nearby residential well users.
  - To bound the extent of groundwater contamination deeper in bedrock
  - To detect groundwater contaminants from the LL or LTR in residential wells in order to assure protection of human health and the environment
  - To provide data for the assessment of the impact of groundwater contaminants from the LL or LTR on aquatic life in the Branch River
  - To detect changes in groundwater contaminant concentrations, and changes in the extent of the contaminant plume exceeding the Wisconsin NR 140 groundwater standards
  - To evaluate contaminant migration pathways and rates
  - To update the evaluation of whether aquifer conditions are favorable for biodegradation of contaminants
  - To detect contaminants migrating from the LL and LTR

- **Treated Effluent Samples:**

  Treated effluent sample data will be used to demonstrate the operating status of the groundwater treatment system, and to verify compliance with the WPDES discharge permit.

- **Leachate Samples:**

  Leachate sample data will be used for the following purposes:

  - To determine whether leachate is in contact with the waste
  - To assess the potential for leachate to migrate to shallow and deeper groundwater

- **Gas Probe and Vent Samples:**

  Gas probe and vent monitoring will be performed to ensure there is no build up of gas beneath the landfill cap, or gas migration from the landfill.

QAPP Worksheet #11-1 (continued)
Project Quality Objectives/Systematic Planning Process Statements
(Long Term Monitoring)

What types of data are needed (target analytes, analytical groups, field-screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

Sampling and analytical protocols are defined later in this document.

- **Groundwater Samples**

  Discrete groundwater samples will be collected from each well according to the program and schedule in Attachment 1. Groundwater samples will be collected using a low-flow purging and sampling technique, and a flow-through cell equipped with probes to measure pH, temperature, specific conductance, dissolved oxygen, and redox potential will be used to collect field measurements. Field measurements will be used during purging to determine when the well has been purged adequately to produce a representative groundwater sample. Each of the samples will be analyzed in accordance with the analytical program specified in Attachment 1. All of the analyses will be performed under standard laboratory turnaround times. The analytical methods are as follows: VOCs (SW-846 8260B), SVOCs (SW-846 8270C/8270C-SIM/EPA 522 Modified [1,4-dioxane]), PCBs (SW-846 8082A), Pesticides (SW-846 8081A), Metals (SW-846 6120), Alkalinity (SM 2320B), Cyanide, total (EPA 335.4), Chloride and sulfate (EPA 300.0), Nitrate + Nitrite (EPA 300.0 or 353.2).

- **Treated Effluent Samples:**

  Discrete samples of the treated effluent will be collected from the discharge line of the groundwater treatment system, and analyzed in accordance with the schedule and analytical program in Attachment 1. The analytical methods are as follows: VOCs (SW-846 8260B), SVOCs (SW-846 8270C/8270C-SIM/8270D), PCBs (SW-846 8082A), Pesticides (SW-846 8081A/8270D), Dioxins/furans (SM 1613B), Metals (SW-846 6020A), Alkalinity (SM 2320B), Ammonia (EPA 350.1), BOD (SM 5210B), Cyanide, total and amenable (EPA 335.4), Chloride (EPA 300.0), Hardness (SW-846 6020A), Hexavalent Chromium (SW-846 7196A), Phosphorus, total (EPA 365.4), Total Suspended Solids (SM 2540D). The analytical lists defined for the treated effluent monitoring are modified from the TALs (Worksheets 15-1 through 15-7) and are reflective of the currently approved monitoring program under the WPDES

  Samples of treatment system effluent will be analyzed periodically for 1,4-dioxane (EPA 522 Modified) at a scheduled to be determined, and as required by USEPA.

- **Leachate Samples:**

  Discrete samples of the leachate will be collected from the leachate collection tanks, and analyzed in accordance with the schedule and analytical program in Attachment 1. The analytical methods are as follows: VOCs (SW-846 8260B), SVOCs (SW-846 8270C/8270C-SIM/EPA 522 Modified [1,4-dioxane]), PCBs (SW-846 8082A), Pesticides (SW-846 8081A), Dioxins/furans (SM 1613B), Metals (SW-846 6020A), BOD (SM 5210B), Cyanide, total and amenable (EPA 335.4), Phosphorus, total (EPA 365.4), Total Suspended Solids (SM 2540D). The analytical lists for the leachate monitoring are modified from the TALs (Worksheets 15-1 through 15-7) and are reflective of the currently approved monitoring program, with the addition of 1,4-dioxane.

  Samples of leachate from the leachate head and leachate extraction wells will be collected periodically, at a schedule to be determined, and as required by USEPA. Samples from the leachate head and leachate extraction wells may be analyzed for all, or a subset of, the parameter groups included in the groundwater analytical program (above). The actual analytical program will be determined prior to sampling, as required by USEPA.

- **Gas Probe and Gas Vent Samples:**

  No samples for laboratory analysis are scheduled for collection. Field measurements of barometric pressure, pressure trend, oxygen, and methane will be collected annually.

QAPP Worksheet #11-1 (continued)
Project Quality Objectives/Systematic Planning Process Statements
(Long Term Monitoring)

How "good" do the data need to be in order to support the environmental decision?

Field measurements of pH, temperature, specific conductance, redox potential, dissolved oxygen, and turbidity will be collected with meters calibrated in accordance with the manufacturer's requirements, and as specified in Worksheet 22. Data of this level of quality are sufficient to determine the representativeness of the groundwater samples collected, and for providing information for basic field level decisions.

Samples for VOCs, dissolved gases, SVOCs, PCBs, pesticides, metals, and wet chemistry analysis will be collected and analyzed in accordance with the performance standards of the EPA standards listed above. EPA methods provide sufficient data quality for making decisions on the groundwater plume extent. In addition, the collected data must meet the appropriate analytical QA/QC requirements to be considered valid (e.g. Worksheets 12, 15, 19-28, 31-37).

Verifiable data are necessary to determine ROD compliance.

How many data are needed (number of samples for each analytical group, matrix, and concentration)?

Groundwater, effluent, and leachate samples (when the system is operational) are collected on a quarterly basis, and analyzed according to the analytical program in Attachment 1. This frequency and number of samples is sufficient to determine any changes in the extent of the contaminant plume, and the constituents in the leachate. Gas monitoring will be performed at six gas probes and 36 gas vents at the LL annually. This samples all the available monitoring points and is enough to compare with previous data.

Where, when, and how should the data be collected/generated?

- **Groundwater Samples:**

  Groundwater samples will be collected on a quarterly basis, in accordance with the analytical program included in Attachment 1. Details of the sample collection methodology for the Long Term Monitoring Program are included later in this document, in field sampling SOP F-1 (Attachment 2).

- **Treated Effluent Samples:**

  Treated effluent samples will be collected on a quarterly basis following the performance of an operation system check, and the samples will be analyzed in accordance with the program included in Attachment 1. The sample collection methodology is as follows: The groundwater extraction system will be engaged and approximately 15,000 gallons of water will be run through the system. At the end of the performance check, a sample will be collected from a sample port on the effluent discharge line. Field measurements of pH, temperature, and specific conductance will be recorded at the time of sampling.

QAPP Worksheet #11-1 (continued)
Project Quality Objectives/Systematic Planning Process Statements
(Long Term Monitoring)

Where, when, and how should the data be collected/generated? (continued)

- **Leachate Samples:**

  Leachate samples will be collected on a quarterly basis only when the leachate extraction system is in operation. The samples will be analyzed in accordance with the program included in Attachment 1. The sample collection methodology is as follows: A leachate sample will be collected from the influent line to the leachate collection tanks.

  If samples from the individual leachate head (LH) or leachate extraction (LW) wells are collected, the wells will be sampled as monitoring wells, following the protocol outlined in SOP F-1 (Attachment 2). The samples will be analyzed for all, or subset of, the standard groundwater monitoring program. The location of these sampling locations is illustrated on Figure 1.

- **Gas Probe and Vent Samples:**

  Direct measurements of oxygen, methane, and barometric pressure will be collected from six gas probes and 36 gas vents at the LL on an annual basis. The samples will be collected in accordance with the protocol outlined in SOP F-2. The locations of these wells are illustrated in Figure 6.

Who will collect and generate the data?

TRC will collect the samples; Pace Analytical – Green Bay will analyze the samples and issue data reports; and TRC will validate the data.

How will the data be reported?

All of the compositional analyses will be available within three weeks of receipt at the laboratory. Level IV reports, where required (Attachment 1), will be available within 5 weeks of receipt at the laboratory. Field data will be incorporated into the project database. Quarterly data transmittals will be generated as specified in Worksheet 16-1, and an annual O&M report summarizing the annual data will be generated as specified in Worksheet 16-1.

How will the data be archived?

Validated data will be archived in an appropriate computer database to ensure that information is readily available, searchable, and compatible with a GIS system. EDDs of site data will be generated and submitted to the WDNR Groundwater Environmental Monitoring System (GEMS) Database as specified in Worksheet 16-1.

QAPP Worksheet #11-2
Project Quality Objectives/Systematic Planning Process Statements
(Groundwater Monitoring Well Installation)

Who will use the data?

LSRG; TRC; USEPA; WDNR

What will the data be used for?

- **Geologic Logging**
  - Geologic logs from the new boreholes will be used in conjunction with the results of the vertical profiling and the geophysical surveying to evaluate groundwater flow in a fractured bedrock environment.
- **Vertical Profiling (Groundwater)**
  - The discrete interval groundwater sampling will provide the data needed to define the vertical extent of contaminants within the bedrock plume, and determine the appropriate well screen elevations for the new monitoring wells.
- **Geophysical Surveys:**
  - Downhole geophysics will include caliper and borehole televiewer observations to assist in locating any enlarged fractures or voids. Electrical resistivity and natural gamma logging may also be conducted as a possible means to correlate intra-borehole features. Additionally, a borehole flowmeter equipped with inflatable packers (straddle packers) may be deployed to measure groundwater flow from discrete intervals in the aquifer found to be fractured using the geophysical measurements.
- **Monitoring Well Installation**
  - The new monitoring wells will be incorporated into the LTMP (as summarized in the GMP [TRC, 2011a]) to ensure the long term protectiveness of the monitoring network.

QAPP Worksheet #11-2 (continued)
Project Quality Objectives/Systematic Planning Process Statements
(Groundwater Monitoring Well Installation)

What types of data are needed (target analytes, analytical groups, field-screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

Sampling and analytical protocols are defined in the project specific SAP (TRC, 2011b) and Worksheet 23.

- **Geologic Logging**

  No laboratory analytical data will be collected as a part of the geologic logging. Geologic logs will be prepared in accordance with the SAP (TRC, 2011b).

- **Vertical Profiling (Groundwater)**

  Groundwater samples will be collected from discrete intervals within the deep monitoring well boring at each well/well nest location, in accordance with the SAP (TRC, 2011b). Field measurements of pH, temperature, specific conductance, redox potential, dissolved oxygen, and turbidity will be collected during purging and sampling using a Geotech P3 (or equivalent) flow-through cell and a Hach 2100P turbidity meter (or equivalent).

  Groundwater samples from the discrete intervals will be analyzed by an off-site laboratory for TAL VOCs (SW-846 8260B).

- **Geophysical Surveys:**

  No laboratory analytical data will be collected as a part of the geophysical survey. Downhole geophysics will include caliper and natural gamma measurements, as well as the use of a televiewer to provide direct observation of the *in situ* bedrock and associated fractures. Electrical resistivity/conductivity and interval flow measurements may also be conducted.

- **Monitoring Well Installation:**

  Monitoring wells will be installed in accordance with Wisconsin Administrative Code Chapter NR 141. The wells will be incorporated into the LTMP, and sampled in accordance with SOP F-1 (Attachment 2). The analytical schedule and program are defined in Attachment 1.

QAPP Worksheet #11-2 (continued)
Project Quality Objectives/Systematic Planning Process Statements
(Groundwater Monitoring Well Installation)

How "good" do the data need to be in order to support the environmental decision?

Field measurements of pH, temperature, specific conductance, redox potential, dissolved oxygen, and turbidity will be collected with meters calibrated in accordance with the manufacturer's requirements, and as specified in Worksheet 22.

Samples for VOCs will be collected and analyzed in accordance with the performance standards of the USEPA standards listed above. In addition, the collected data must meet the appropriate analytical QA/QC requirements to be considered valid (e.g. Worksheets 12, 15, 19-28, 31-37).

Verifiable data are necessary to determine ROD compliance.

How many data are needed (number of samples for each analytical group, matrix, and concentration)?

- **Geologic Logging:**
  - No laboratory analytical data will be collected as a part of the geologic logging
  - One boring log will be generated for the deepest borehole at each monitoring well nest location.
- **Vertical Profiling (Groundwater):**
  - Discrete groundwater samples will be collected from the deepest borehole at each monitoring well nest location. Samples will be collected at 20-foot intervals within the boreholes, in accordance with the SAP (TRC, 2011b). The samples will be analyzed for VOCs and field parameters.
- **Geophysical Surveys:**
  - No laboratory analytical data will be collected as a part of the geophysical surveys.
  - A geophysical survey will be performed on the deepest borehole at each monitoring well nest location.
- **Monitoring Well Installation:**
  - No laboratory analytical data will be collected as a part of the monitoring well installation. Monitoring wells will be sampled for analytical data in accordance with the LTMP, and Attachment 1.

QAPP Worksheet #11-2 (continued)
Project Quality Objectives/Systematic Planning Process Statements
(Groundwater Monitoring Well Installation)

Where, when, and how should the data be collected/generated?

The sampling program, including maps of the existing and proposed well locations is described in detail in the SAP (TRC 2011b). Samples will be collected in accordance with field methods contained within the SAP.

- **Geologic Logging:**
  Geologic logs will be prepared in the field for the deep boring location at each well nest. Logging methodology is described in detail in the SAP (TRC, 2011b).
- **Vertical Profiling (Groundwater):**
  Discrete depth interval sampling will be performed at the deep boring location at each well nest during borehole installation. Sampling methodology is described in detail in the SAP (TRC, 2011b)
- **Geophysical Surveys:**
  The WGNHS will perform borehole geophysical surveys on the monitoring well borings prior to well installation.
- **Monitoring Well Installation:**
  Monitoring wells will be sampled in accordance with the LTMP.

Who will collect and generate the data?

TRC will collect the samples; Pace Analytical – Green Bay will analyze the samples and issue data reports; and TRC will validate the data.

How will the data be reported?

The results of the groundwater monitoring well installation fieldwork program will be compiled and presented in O&M Progress Report (See Worksheet 16-2).

How will the data be archived?

Validated data will be archived in an appropriate database to ensure that information is readily available, searchable, and compatible with a GIS system.

QAPP Worksheet #12-1
Measurement Performance Criteria (Volatile Organic Compounds - Water)

Matrix: Aqueous
Analytical Group: VOCs by 8260B
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 01	Precision-overall	RPD < 35%	Field duplicate	S&A
	Analysis: Pace 01	Accuracy/Bias	%Rec, laboratory generated limits[4]	Surrogate	A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A
		Accuracy/Bias	-50% to +200%	Internal standards	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-2
Measurement Performance Criteria (Dissolved Gases - Water)

Matrix: Aqueous
Analytical Group: Dissolved Gases (methane, ethane, ethene)
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 06	Precision-overall	RPD < 35%	Field duplicate	S&A
	Analysis: Pace 06	Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 30%	MS/MSD and LCS/LCSD[3]	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-3
Measurement Performance Criteria (Semivolatile Organic Compounds – Water)

Matrix: Aqueous
Analytical Group: SVOCs by 8270C
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 17	Precision-overall	RPD < 35%	Field duplicate	S&A
	Analysis: Pace 02	Accuracy/Bias	%Rec, laboratory generated limits[4]	Surrogate	A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD or LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD or LCS/LCSD[3]	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-4
Measurement Performance Criteria (Polynuclear Aromatic Compounds – Water)

Matrix: Aqueous
Analytical Group: PAHs by 8270C – SIM
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)	Preparation: Pace 17 Analysis: Pace 03	Precision-overall	RPD < 35%	Field duplicate	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	Surrogate	A
		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A
		Accuracy/Bias	-50% to +200%	Internal standards	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-5
Measurement Performance Criteria (Polychlorinated Biphenyls - Water)

Matrix: Aqueous
Analytical Group: PCBs by 8082A
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 17	Precision-overall	RPD < 35%	Field duplicate	S&A
	Analysis: Pace 04	Accuracy/Bias	%Rec, laboratory generated limits[4]	Surrogate	A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
		Accuracy/Bias	Retention times/pattern recognition, see analytical SOP	Retention time windows/pattern recognition	A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-6
Measurement Performance Criteria (Organochlorine Pesticides - Water)

Matrix: Aqueous
Analytical Group: Organochlorine Pesticides by 8081A
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 17	Precision-overall	RPD < 35%	Field duplicate	S&A
	Analysis: Pace 05	Accuracy/Bias	%Rec, laboratory generated limits[4]	Surrogate	A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-7
Measurement Performance Criteria (Organophosphate Pesticides/SVOCs - Water)

Matrix: Aqueous
Analytical Group: Organophosphate Pesticides/SVOCs by 8270D
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)	Preparation: Pace 17 Analysis: Pace 21	Precision-overall	RPD < 35%	Field duplicate	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	Surrogate	A
		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A
		Accuracy/Bias	-50% to +200%	Internal standards	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-8
Measurement Performance Criteria (Dioxins and Furans – Water)

Matrix: Aqueous
Analytical Group: Dioxins and Furans
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 07	Precision-overall	RPD < 100%	Field duplicate	S&A
	Analysis: Pace 07	Accuracy/Bias contamination	< RL	Blanks (field, equipment, method specific)	S&A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias	%R, laboratory-generated limits	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD <35%	MS/MSD and LCS/LCSD[3]	A
		Accuracy/Bias	%R, laboratory-generated limits	Internal standards (labeled surrogates)	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-9
Measurement Performance Criteria (Metals - Water)

Matrix: Aqueous
Analytical Group: Metals, Target Analyte List (except mercury)
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 08	Precision-overall	RPD < 35%	Field duplicate	S&A
	Analysis: Pace 08	Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A
		Precision	Sample > 5x RL, RPD ≤ 20% sample < 5x RL, no limit	Laboratory duplicate	A
		Accuracy/Bias	80-120%	Post digestion spike	A
		Accuracy	% Rec > 80%	Interference check sample	A
		Accuracy	RPD ≤ 10%	Serial dilution	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-10
Measurement Performance Criteria (Mercury - Water)

Matrix: Aqueous
Analytical Group: Mercury
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 09	Precision-overall	RPD < 35%	Field duplicate	S&A
	Analysis: Pace 09	Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A
		Precision	Sample > 5x RL, RPD ≤ 20% sample < 5x RL, no limit	Laboratory duplicate	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-11
Measurement Performance Criteria (Wet Chemistry – Water)

Matrix: Aqueous

Analytical Group: Wet Chemistry (chloride, nitrite, nitrate, ammonia, sulfate, alkalinity, hardness, total phosphorus, total cyanide, hexavalent chromium)

Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)	Chloride, sulfate: Pace 16 Nitrite, nitrate: Pace 16 Ammonia: Pace 12 Alkalinity: Pace 15 Total phosphorus: Pace 14 Total cyanide: Pace 11 Hexavalent chromium: Pace 10	Precision-overall	RPD < 35%	Field duplicate	S&A
		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A
		Precision	Sample > 5x RL, RPD ≤ 20% sample < 5x RL, no limit	Laboratory duplicate	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-12
Measurement Performance Criteria (Wet Chemistry-Water)

Matrix: Aqueous
Analytical Group: Biochemical Oxygen Demand, Total Suspended Solids
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	BOD: Pace 18 TSS: Pace 19	Precision-overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias	%Rec, laboratory generated limits	LCS	A
		Precision	Sample > 5x RL, RPD ≤ 30% sample < 5x RL, no limit	Laboratory duplicate	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-13
Measurement Performance Criteria (Amenable Cyanide - Water)

Matrix: Aqueous
Analytical Group: Amenable Cyanide
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 20 Analysis: Pace 20	Precision-overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-14
Measurement Performance Criteria (1,4-Dioxane - Water)

Matrix: Aqueous
Analytical Group: 1,4-Dioxane by EPA 522 Modified
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)	Preparation: Pace 23 Analysis: Pace 23	Precision-overall	RPD < 35%	Field duplicate	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	Surrogate	A
		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 30%	MS/MSD and LCS/LCSD[3]	A
		Accuracy/Bias	-70% to +150%	Internal standards	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #12-15
Measurement Performance Criteria (Vinyl Chloride - Water)

Matrix: Aqueous
Analytical Group: Vinyl Chloride by 8260
Concentration Level: Low level

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-1 for LTMP	Preparation: Pace 24	Precision-overall	RPD < 35%	Field duplicate	S&A
	Analysis: Pace 24	Accuracy/Bias	%Rec, laboratory generated limits[4]	Surrogate	A
Sampling methods for additional tasks (e.g. monitoring well installation) are included in the SAP (TRC, 2011b)		Accuracy/Bias contamination	< RL	Blanks (field, equipment, method-specific)	S&A
		Accuracy/Bias	%Rec, laboratory generated limits[4]	MS/MSD and LCS/LCSD[3]	A
		Precision	%RPD < 20%	MS/MSD and LCS/LCSD[3]	A
		Accuracy/Bias	-50% to +100%	Internal standards	A

Footnotes:
(1) Reference number from QAPP Worksheet #21.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(4) See Attachment 3.

QAPP Worksheet #13
Secondary Data Criteria and Limitations

SECONDARY DATA	DATA SOURCE (originating organization, report title, and date)	DATA GENERATOR(S) (originating organization, data types, data generation/ collection dates)	HOW DATA WILL BE USED	LIMITATIONS ON DATA USE
Groundwater Performance Monitoring (Historical Data)	RMT, Inc./TRC (beginning in June 2011); various titles; data currently submitted to the USEPA and WDNR quarterly as "Data Transmittals"	RMT, Inc./TRC (beginning June 2011); sample dates from December 1996 through June 2011 (ongoing); monitoring well samples, residential well samples, water level monitoring data.	▪ Used to evaluate site conditions, and the effectiveness of the remedial action ▪ Used to evaluate trends in water chemistry over time	None[1] Historical detections of bis(2-ethylhexyl)phthalate (BEHP) are believed to be sampling or laboratory artifacts; future BEHP detections, if any, will be evaluated as a part of the data validation process.
Treated Effluent Monitoring (Historical Data)	RMT, Inc./TRC (beginning in June 2011); various titles; data submitted to the WDNR quarterly in the form of Discharge Monitoring Reports; data included in electronic data deliverables (EDDs) submitted to the WDNR on a quarterly basis as a part of the Groundwater Performance Monitoring	RMT, Inc./TRC (beginning in June 2011); sample dates from March 1997 through July 2011 (ongoing); system influent samples, system effluent samples.	▪ Used to evaluate the effectiveness of the treatment system	None[1]
Leachate Monitoring (Historical Data)	RMT, Inc.; No reports generated; data submitted to Heart of the Valley Wastewater Treatment Facility for wastewater disposal evaluation; data included in EDDs submitted to the WDNR on a quarterly basis as a part of the Groundwater Performance Monitoring	RMT, Inc.; sample dates from March 1997 through October 2008, while system operational; leachate samples.	▪ Used to verify that concentrations of contaminants in the leachate are within the acceptance criteria of the treatment facility prior to disposal.	None[1]

[1] Data were collected and analyzed In accordance with USEPA-approved planning documents (see Section 1.1 for dates of approved planning documents).

QAPP Worksheet #13 (continued)
Secondary Data Criteria and Limitations

SECONDARY DATA	DATA SOURCE (originating organization, report title, and date)	DATA GENERATOR(S) (originating organization, data types, data generation/ collection dates)	HOW DATA WILL BE USED	LIMITATIONS ON DATA USE
Leachate Head Well Monitoring	RMT, Inc./TRC (beginning in June 2011); various titles; data submitted to the WDNR annually (if collected) in the form of the annual O&M progress report; data included in electronic data deliverables (EDDs) submitted to the WDNR on a quarterly basis as a part of the Groundwater Performance Monitoring.	RMT, Inc./TRC (beginning in June 2011); water level data collected monthly beginning in March 1997 (ongoing); chemical analysis from selected leachate head or leachate extraction wells in July 2000, December 2008, and August 2010.	▪ Used to evaluate site conditions, and the effectiveness of the remedial action ▪ Used to evaluate leachate chemistry	None[1]
Branch River Ecological Monitoring (Historical Data)	No report generated; data transmitted to USEPA and WDNR via correspondence.	RMT, Inc.; sediment samples in October and December 1998, and September 2000; surface water samples from December 1996 through October 2003.	▪ Used to assess chemical and biological changes in water quality, river sediment, and benthic macro-invertebrates over the first three years of operation of the groundwater treatment system	None[1]
Gas Migration Monitoring (Historical Data)	RMT, Inc.; various titles; data submitted annually in the site Observation and Monitoring Progress Reports; data included in EDDs submitted to the WDNR on a quarterly basis as a part of the Groundwater Performance Monitoring.	RMT, Inc.; April 1997 through November 2010 (ongoing); field measurements of methane, oxygen, carbon dioxide, and non-methane VOCs.	▪ Used to assess gas generation and gas migration	None[1]
Geologic Information from site boring logs	B&V Waste Science & Technology Corporation, 1991. Final Remedial Investigation Report for Lemberger Landfill, Inc. Site and Lemberger Transport and Recycling, Inc. Site. Prepared for United States Environmental Protection Agency. January 18, 1991.	B&V Waste Science & Technology Corporation; soil boring logs; data generated prior to 1991.	▪ Used to define site geology and interpret hydrogeology ▪ Used to assess physical nature of bedrock	None[1]

QAPP Worksheet #13 (continued)
Secondary Data Criteria and Limitations

SECONDARY DATA	DATA SOURCE (originating organization, report title, and date)	DATA GENERATOR(S) (originating organization, data types, data generation/ collection dates)	HOW DATA WILL BE USED	LIMITATIONS ON DATA USE
Bedrock groundwater samples	RMT, Inc., June 2006. Field Investigation of Bedrock Characteristics, Lemberger Transport and Recycling Landfill Site.	RMT, Inc.; September 2005 and March 2006; groundwater samples from bedrock borings for chemical analysis	▪ Used to assess physical nature and distribution of contaminants in the bedrock ▪ Used to support a potential future screening of remediation technologies	None[1]
Bedrock groundwater samples	RMT, Inc., December 2008. Deep Monitoring Well Installations at the Lemberger Landfill and Lemberger Transport and Recycling Sites, Franklin Township, Manitowoc County, Wisconsin.	RMT, Inc.; September 2008; groundwater samples from bedrock borings for chemical analysis	▪ Used to define vertical limits of contaminants within the bedrock aquifer	None[1]

[1] Data were collected and analyzed in accordance with USEPA-approved planning documents (see Section 1.1 for dates of approved planning documents).

QAPP Worksheet #14
Summary of Project Tasks

SAMPLING AND ANALYSIS TASKS	
Long Term Monitoring Program	
Sampling tasks:	▪ Perform quarterly groundwater sampling at the LL and LTR sites, as specified in the Groundwater Monitoring Plan (RMT, 2011a). — Collect water level data at all existing site wells semi-annually (March and September) — Collect groundwater samples from selected site monitoring wells, site groundwater extraction wells, and area residential wells following the Quarterly, Semi-Annual, and Annual programs, as outlined in the table in Attachment 1. ▪ Perform immediate resampling in the event of the following: — If the sample results indicate a detection of a CVOC associated with LL or LTR or 1,4-dioxane at or above 1 ug/L in a residential well or sentinel well, unless the CVOC or 1,4-dioxane has been detected at the sentinel or residential well within the last 5 years. — If the sample results indicate a detection of a CVOC associated with LL or LTR, or 1,4-dioxane at or above 1 ug/L in a residential well or sentinel well where the compound has been detected within the last 5 years, but the reported concentration exceeds 5 times its highest detection within the last 5 years. ▪ Perform Operating Status checks on the groundwater treatment system — Confirm extraction system operation on a quarterly basis (January, April, July, October) — Collect one sample of system effluent during system operation to verify the effectiveness of the treatment system ▪ Perform Leachate monitoring on a quarterly basis when the leachate withdrawal system is in operation. ▪ Perform gas monitoring at the LTR on an annual basis
Analysis tasks:	▪ All analytical samples will be submitted to Pace Analytical in Green Bay, Wisconsin, for analysis in accordance with the analytical program (Attachment 1) ▪ Analytical samples will be analyzed by Pace Analytical, Green Bay or authorized subcontracting laboratory (with current Wisconsin certification or otherwise approved by the USEPA and WDNR). ▪ All analyses will be performed within standard turnaround times.
Quality control tasks:	The samples will be collected and processed, and the laboratory waste will be disposed, as described in the laboratory SOPs. QA samples will be collected as described in Worksheet #20.
Secondary data:	See Worksheet 13.

QAPP Worksheet #14 (continued)
Summary of Project Tasks

SAMPLING AND ANALYSIS TASKS	
Groundwater Monitoring Well Installation	
Sampling tasks:	▪ Generate geologic logs during borehole installation. ▪ Collect water samples from discrete intervals within the deepest borehole at each well nest location. ▪ Observe and document the downhole geophysical survey performed by WGNHS. ▪ Observe and document the installation of each new monitoring well.
Analysis tasks:	Analytical samples will be processed, prepared, and analyzed as follows: ▪ All groundwater samples collected during vertical profiling will be analyzed for VOCs by Pace Analytical in Green Bay, Wisconsin, and field parameters (pH, temperature, specific conductance, dissolved oxygen, and redox potential) will be collected at the time of sampling. ▪ Groundwater samples collected from the new monitoring wells will be analyzed in accordance the LTMP ▪ Samples will be analyzed with standard turnaround times.
Quality control tasks:	The samples will be collected and processed, and the laboratory waste will be disposed, as described in the laboratory SOPs. QA samples will be collected as described in Worksheet #20.
Secondary data:	See Worksheet 13.

QAPP Worksheet #14 (continued)
Summary of Project Tasks

DATA MANAGEMENT, DOCUMENTATION, RECORDS, AND AUDIT TASKS	
Data management tasks:	▪ **Field data reduction** - Raw data from field measurements and sample collection activities will be recorded as specified in the SAP (TRC, 2011b). If the data are to be used in the project reports, they will be reduced or summarized, and the method of reduction will be documented in the report. No calculation will be involved in field data reduction. The On-site Coordinator or designee will proofread all forms and notebooks to determine if transcription errors have been made by the field crew. ▪ **Laboratory data reduction** – Pace Analytical will perform in-house analytical data reduction under the direction of the laboratory QA/QC Manager. The laboratory QA/QC Manager will be responsible for assessing data quality and advising of any data that were rated "preliminary" or "unacceptable" or of other notations that would caution the data user of possible unreliability. Data reduction, by the laboratory, will be conducted as follows: — The analysts who produced the laboratory data will first conduct a systematic review (Level 1 Review). — An experienced peer, supervisor, or designee will examine the data (the Level 2 Review) to ensure that the Level 1 review has been completed correctly and thoroughly. Following the Level 2 review, the data will be turned over to the Laboratory Project Manager for a third-level review. — The Laboratory Project Manager will review the data for completeness and attainment of quality control criteria as outlined in the USEPA methods and for overall reasonableness. — The Laboratory Project Manager will verify the accuracy and completeness of the final reports. — The Laboratory QA/QC Manager and the supervisor of the pertinent analytical section, in conjunction with the TRC Data QA Manager and TRC Project Manager, will decide whether any sample reanalysis is required. — Data reduction procedures are included in the USEPA-approved methods and associated laboratory SOPs. ▪ **Field data reporting** - Field data reporting will consist of field logs and calibration and measurement records documenting site activities as described in the SAP, and on the sample Chain-of-Custody Records.

QAPP Worksheet #14 (continued)
Summary of Project Tasks

DATA MANAGEMENT, DOCUMENTATION, RECORDS, AND AUDIT TASKS	
Data management tasks: (continued)	▪ **Laboratory data reporting** - The analytical laboratories will prepare and retain full analytical and QC documentation. Such retained documentation need not be on hard (paper) copy, but may be in other storage media (*e.g.*, computer diskette or magnetic tape). As needed, Pace Analytical will supply a hard copy of the retained information. Pace Analytical will provide the following information in each analytical data package submitted (Pace Level III data packages): — Dated cover sheets, signed by the Pace Analytical Project Manager, listing a laboratory batch number; the analyses performed; the number of samples and respective matrices; the project name and number; narrative comments describing deviations from intended analytical strategy, and any problems encountered in analysis; and a discussion of any laboratory quality control checks that failed to meet project criteria — Tabulated results of inorganic and organic compounds identified and quantified, including sample preparation and analysis dates, and cross-references of laboratory and field sample identification numbers — Analytical results for QC sample spikes and sample duplicates; initial and continuing calibration verifications of standards and blanks; standard procedural blanks; laboratory control samples; and the data produced by ICP interference check samples, as appropriate for the specified analyses — Tabulation of Method Detection Limits, as appropriate Pace Analytical will provide the following information in Pace Level IV data packages: — Raw data system printouts (or legible photocopies) identifying the date of analyses, the mass spectra tuning data, the name of the analyst, the parameters determined, the initial and continuing calibration, the calibration verification summary, the method blanks, the sample and any dilutions, sample duplicates and spikes, chromatograms, GC/MS spectra, computer printouts, internal standard area and RT summary, cleanup information, control samples, ICP outputs, and inter-element correction data Laboratory data reporting levels for sampling tasks will be as specified in the analytical programs included in Attachment 1. A report will be prepared containing a QA/QC section summarizing the quality of the data. The QA report prepared under the direction of TRC Data QA Manager will address the assessment of data precision, accuracy, completeness, and comparability; the results of performance audits, if any; the results of system audits; any reported nonconformances; any significant QA/QC problems and recommended solutions; the results of corrective actions since the last report; and approved revisions to the QA/QC processes. The report will indicate whether the QA objectives were met and whether the data can be used for the intended purposes based on an evaluation of compliance with control limits, the results of audits, and compliance with the procedures specified in the QAPP and the SAP.

QAPP Worksheet #14 (continued)
Summary of Project Tasks

DATA MANAGEMENT, DOCUMENTATION, RECORDS, AND AUDIT TASKS	
Documentation and records:	Appropriate records will be maintained to provide adequate documentation of the entire data generation process, including field sampling and laboratory analysis. ▪ **Field documentation** - Field personnel will develop and retain comprehensive records of field activities, including field sampling, field analysis, and sample Chain-of-Custody, to allow a reconstruction of field events and sample handing during data review and interpretation. ▪ **Laboratory project files** – Pace Analytical will maintain a file for pertinent project information, including Chain-of-Custody Records; other custody documents (air bills, etc.); work orders; Sample Receipt Acknowledgment Forms, if any; instrument detection limit and control limit tabulations; all raw analytical data on bench sheets; laboratory data; and project communication records. Such retained documentation need not be on hard (paper) copy, but may be in other storage media (*e.g.*, computer diskette or magnetic tape). As needed, Pace Analytical will supply a hard copy of the retained information. ▪ **Laboratory notebooks** - Logbooks, bench sheets, instrument notebooks, and instrument printouts will be retained as part of the permanent laboratory record, including the associated quality controls. Each page in the laboratory logbooks and bench sheets will be signed and dated by the analyst, and errors will be crossed out in indelible ink. System printouts of raw inorganic and organic data will include dates of analyses; analyst's name; parameters determined; calibration curve; calibration verifications; method blanks; sample number and dilutions performed; and sample duplicates, spikes, and control samples. Internal laboratory QC sample results will be indicated on the analytical bench sheets and will include sample spikes, sample duplicates, initial and continuous calibration verification of standards and blanks, standard procedural blanks, laboratory control samples, ICP serial dilutions, and ICP interference check samples. ▪ **Computer and hard copy storage** - All electronic files and deliverables will be retained by the laboratory for no less than 5 years. LSRG, or its designated representatives, will retain copies of the analytical data reports according to the requirements of the laboratory QA Manual. All field records will be kept in the central project file at the TRC office at 708 Heartland Trail, Madison, Wisconsin; and records will be included in project reports, as appropriate, or upon request by the USEPA RPM. ▪ **Field data reporting** - Field data reporting will consist of field notebooks and logs, photographs, boring logs, calibration and measurement records, and Chain–of-Custody (COC) documentation, including field quality control samples that will be collected to assess the quality of the analytical data and to evaluate sampling and analytical reproducibility. Field records will be reviewed by the TRC Project Manager for consistency with the planned activities, and any concerns will be discussed with the On-site TRC Coordinator. Field performance and field system audits will also be performed, as discussed below and in Worksheets #31 and 32.

QAPP Worksheet #14 (continued)
Summary of Project Tasks

DATA MANAGEMENT, DOCUMENTATION, RECORDS, AND AUDIT TASKS	
Documentation and records: (continued)	▪ **Laboratory data reporting** - Analytical data for this project will be reported in both an electronic data deliverable (EDD) and an analytical data package. The EDD will be generated by Pace Analytical and will be used by TRC to facilitate loading the analytical data into the project database. The Laboratory QA/QC Manager will perform a final review of the report summaries and case narratives to determine if the report meets project requirements. The task of reporting laboratory data to the USEPA will begin after the data review activity has been concluded. The validated analytical data will be provided to the USEPA in accordance with the project schedule (Worksheet #16). In addition to the COC Record, Pace Analytical will prepare and provide a full "CLP-like" data package, including the following (raw data included only for Level IV reports): — **Case narrative** - date of issuance; laboratory analysis performed; any deviations from required analytical methods; laboratory sample lot numbers; numbers of samples and respective matrices; QC procedures used and references to the acceptance criteria; laboratory report table of contents; project name and number; condition of samples upon receipt; dates of extraction, preparation, and analysis; discussion of whether or not sample holding times were met; discussion of technical problems or other observations that may have created analytical difficulties; discussion of any laboratory QC checks that failed to meet project criteria; signature of the laboratory Project Manager, and copies of the COC Records — **Chemistry data package** - run log, summary page indicating dates of analyses for samples and laboratory QC checks, cross-referencing of laboratory sample to project sample identification numbers, adequately described data qualifiers, sample preparation and analysis methods, sample results, matrix spike and matrix spike duplicate (MS/MSD) recoveries, laboratory control sample recoveries, method blank results, and surrogate recoveries Soil sample analytical data generated by the laboratory will be reported in micrograms per kilogram (µg/kg) or milligrams per kilogram (mg/kg) on a dry-weight basis. Groundwater data will be reported in micrograms per liter (µg/L) or milligrams per liter (mg/L). Results between the laboratory Method Detection Limit (MDL) and the Quantitation Limit (QL) will be reported. Data retained in the project database may be converted to units other than those reported by the laboratories. Sample results will not be corrected for contamination found in laboratory blanks. However, sample results may be qualified as not detected based on laboratory, field, and/or trip blank contamination.

QAPP Worksheet #14 (continued)
Summary of Project Tasks

DATA MANAGEMENT, DOCUMENTATION, RECORDS, AND AUDIT TASKS	
Assessment/Audit tasks:	Performance and system audits will be completed in the field and laboratory, as described below and in Worksheets #31 and 32. ▪ **Field audits** - The TRC Project Manager will monitor day-to-day field performance through daily communications with the On-site Coordinator and the Construction Manager (if applicable). In addition, field performance audits and field system audits will be performed, as follows: — **Field performance audits** - Field performance audits will be conducted in order to confirm that the activities are being performed according to the established plans. The field performance audit(s) will be performed by the Project Manager (or designee) at a frequency that is appropriate for the field activities being performed. The audit(s) will include a discussion of the project progress with the Project Manager and/or the review of field reports, as appropriate. The Data QA Manager will record and document any observations made during field system audits, and will discuss the audit and any recommended changes/deviations to the field procedures with the Project Manager. — **Field system audits** - Field system audits will be performed by the Data QA Manager, including a review of rinse and trip blank data to identify potential deficiencies in field sampling and decontamination procedures, and a comparison of the scheduled QA/QC activities described in this QAPP with the QA/QC procedures being performed on the project. Field system audits will be performed at a frequency appropriate for the field activities. The Data QA Manager will record and document any observations made during field system audits, and will discuss the audit and any recommended changes/deviations to the field procedures with the Project Manager. ▪ **Laboratory audits** - Laboratory audits will be performed, as follows: — **Internal audits** - The Laboratory QA/QC Manager (or designee) will periodically conduct internal laboratory audits. This will include an overall evaluation of the performance of laboratory staff and a comparison of laboratory procedures with the laboratory QA Manual and SOPs. Results of the audits will be summarized and distributed to appropriate laboratory staff. — **External audits** - The Data QA Manager will review the laboratory QA Manual and applicable SOPs, and will discuss laboratory procedures with the Laboratory QA/QC Manager prior to the start of project sampling. The Data QA Manager will record and document any observations made during the review. In addition, as a participant in state and federal certification programs, the laboratory is audited by representatives of the regulatory agency issuing certification. Audits include a review of sample handling and tracking documentation, analytical methodologies, analytical supportive documentation, and final reports. The audit findings are documented and submitted to the laboratory for corrective action, if necessary.

QAPP Worksheet #14 (continued)
Summary of Project Tasks

DATA MANAGEMENT, DOCUMENTATION, RECORDS, AND AUDIT TASKS	
Assessment/Audit tasks: (continued)	▪ **Corrective action** - Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP, as follows: — **Field measurement corrective action** - Corrective action in the field may be necessary when the sample network is changed (*i.e.*, more/fewer samples, sampling locations other than those specified in the SAP, etc.), or when sampling procedures and/or field analytical procedures require modification in response to unexpected conditions. Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances or deficiencies of any activity or issued document by reporting the situation to the TRC On-site Coordinator or designee. The On-site Coordinator will assess the suspected problems in consultation with the Project Manager or Data QA Manager or designee, and will assist in making a decision based on the potential for the situation to impact the data quality. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, the On-site Coordinator will initiate a nonconformance report. If appropriate, the On-site Coordinator will also ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed. — **Laboratory corrective action** - Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. Corrective actions may be necessary if any of the following occur: ▪ QC data are outside the warning or acceptable windows for precision and accuracy. ▪ Blanks contain target analytes above acceptable levels. ▪ Undesirable trends are detected in spike recoveries or the RPD between duplicates. ▪ There are unusual changes in detection limits. ▪ Deficiencies are detected by the Data QA Manager during internal or external audits or from the results of performance evaluation samples. ▪ Inquiries concerning data quality are received. Corrective actions should be timely, and they should determine the root cause and evaluate any propagation of the error or problem. The investigative action taken is somewhat dependent on the analysis and the event. Corrective action in the laboratory may occur prior to, during, or after the initial analysis. Corrective action is under the supervision of the Laboratory QA/QC Manager. Following a consultation with laboratory scientists, technicians, and team leaders, it may be necessary for the Data QA Manager to approve the implementation of the corrective action. Some conditions during or after analysis may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain quality control criteria are not met, etc. Pace Analytical's corrective action procedures are documented in Laboratory SOPs specifying corrective action to be taken when an analytical error is discovered or the analytical system is found to be out of control.

QAPP Worksheet #14 (continued)
Summary of Project Tasks

DATA MANAGEMENT, DOCUMENTATION, RECORDS, AND AUDIT TASKS	
Assessment/Audit tasks: (continued)	Depending on the problem, the corrective action employed may be formal or informal. On-the-spot actions are used to correct minor problems, such as recalibration, retuning, or a minor repair (*e.g.*, replacement of a minor part) of a malfunctioning instrument or the correction of poor analytical technique being used. Corrective action procedures may be handled at the bench level by the analyst, who reviews the preparation or extraction procedure that was used for possible errors, and checks the instrument calibration, spike, and calibration mixes, and the instrument sensitivity. These occurrences are documented in the appropriate injection, run, or analysis logbooks. Similarly, routine instrument maintenance, malfunctions, and power failures are also documented in the appropriate instrument maintenance logbooks. If the problem persists or cannot be identified, the matter may be referred to the laboratory team leader, and/or QA/QC Manager for further investigation. Occurrence of the problem, the corrective action employed, and verification that the problem has been eliminated will be properly documented. The corrective action procedure will be discussed with the Laboratory Project Manager, and full documentation of the corrective action procedure, whether resolved or not, will be placed in the laboratory project file. Corrective actions specific to analytical methods are discussed in the operational-specific SOPs. The USEPA RPM or the TRC Data QA Manager may request corrective action for any nonconformance identified by audits or data validation. — **Corrective action during data validation and data assessment** - The need for corrective actions may be identified during data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory. Data validation corrective actions may include notification of the laboratory of incomplete or erroneous reports and a request for issuance of corrected versions. When the Data QA Manager identifies a corrective action situation, the Project Manager will approve the implementation of corrective action, including possible resampling. The TRC Data QA Manager will notify the laboratory of incomplete or erroneous reports and will request the issuance of corrected versions. All corrective actions will be documented. Final summary data tables will not be issued until all data have been validated and all corrections have been made. Corrective action may include the following: ▪ Reanalysis of samples, if holding time requirements permit ▪ Resampling and analysis ▪ Evaluation and amendment of sampling procedures ▪ Evaluation and amendment of analytical procedures ▪ Acceptance of data and acknowledgment of the level of uncertainty
Data Review tasks:	See Worksheets #36 and 37.

QAPP Worksheet #15-1
Reference Limits and Evaluation (Volatile Organic Compounds - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
VOLATILE ORGANIC COMPOUNDS (VOCs) – TARGET ANALYTE LIST (TAL)						
1,1,1-Trichloroethane	00071-55-6	40	200	8260B	0.9	1
1,1,2,2-Tetrachloroethane	00079-34-5	0.02	0.2	8260B	0.2	1
1,1,2-Trichloroethane	00079-00-5	0.5	5	8260B	0.42	1
1,1-Dichloroethane	00075-34-3	85	850	8260B	0.75	1
1,1-Dichloroethene	00075-35-4	0.7	7	8260B	0.57	1
1,2-Dichloroethane	00107-06-2	0.5	5	8260B	0.36	1
1,2-Dichloropropane	00078-87-5	0.5	5	8260B	0.49	1
2-Butanone	00078-93-3	800	4000	8260B	4.3	20
2-Hexanone	00591-78-6	--	--	8260B	1.97	5
4-Methyl-2-pentanone	00108-10-1	50	500	8260B	1.2	5
Acetone	00067-64-1	1800	9000	8260B	4.99	20
Benzene	00071-43-2	0.5	5	8260B	0.41	1
Bromodichloromethane	00075-27-4	0.06	0.6	8260B	0.56	1
Bromoform	00075-25-2	0.44	4.4	8260B	0.94	1

QAPP Worksheet #15-1 (continued)
Reference Limits and Evaluation (Volatile Organic Compounds - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
Bromomethane	00074-83-9	1	10	8260B	0.91	1
Carbon disulfide	00075-15-0	200	1000	8260B	0.66	1
Carbon tetrachloride	00056-23-5	0.5	5	8260B	0.49	1
Chlorobenzene	00108-90-7	20	100	8260B	0.41	1
Chlorodibromomethane	00124-48-1	6	60	8260B	0.81	1
Chloroethane	00075-00-3	80	400	8260B	0.97	1
Chloroform	00067-66-3	0.6	6	8260B	1.3	5
Chloromethane	00074-87-3	3	30	8260B	0.24	1
cis-1,2-Dichloroethene	00156-59-2	7	70	8260B	0.83	1
cis-1,3-Dichloropropene	10061-01-5	0.02	0.2	8260B	0.2	1
Ethylbenzene	00100-41-4	140	700	8260B	0.54	1
Methylene chloride	00075-09-2	0.5	5	8260B	0.43	1
Styrene	00100-42-5	10	100	8260B	0.86	1
Tetrachloroethene	00127-18-4	0.5	5	8260B	0.45	1
Toluene	00108-88-3	160	800	8260B	0.67	1
trans-1,2-Dichloroethene	00156-60-5	20	100	8260B	0.89	1
trans-1,3-Dichloropropene	10061-02-6	0.02	0.2	8260B	0.19	1
Trichloroethene	00079-01-6	0.5	5	8260B	0.48	1
Vinyl chloride	00075-01-4	0.02	0.2	8260C	0.01	0.032
Xylene, total	01330-20-7	400	2000	8260B	2.6	3

QAPP Worksheet #15-1 (continued)
Reference Limits and Evaluation (Volatile Organic Compounds - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
VOLATILE ORGANIC COMPOUNDS – ADDITIONAL PARAMETERS						
1,1-Dichloropropene	00563-58-6	--	--	8260B	0.75	1
2,3-Dichloropropene	00078-88-6	--	--	8260B	0.84	1
2-Chloroethylvinylether	00110-75-8	--	--	8260B	0.95	1
Acrolein	00107-02-8	--	--	8260B	10	10
Acrylonitrile	00107-13-1	--	--	8260B	1.3	5
Dichlorodifluoromethane	00075-71-8	200	1000	8260B	0.99	1
Fluorotrichloromethane	00075-69-4	698	3490	8260B	0.79	1

Footnotes:
(1) From SW-846, Test Methods for Evaluating Solid Waste.
(2) Analyte detected at a concentration above the laboratory LOD but below the laboratory LOQ will be reported and flagged as an estimated concentration. In the event that a laboratory LOD is above the respective Action Limit for that constituent, the laboratory result will be identified during the data validation process and will be specifically noted in a Data Validation Report.
(3) Limits are periodically updated by the laboratory. The current limits at the time of sample analysis will be used.

Notes:
– No standard established.

QAPP Worksheet #15-2
Reference Limits and Evaluation (Dissolved Gases - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
Ethane	74-84-0	--	--	8015B	0.32	5.0
Ethene	74-85-1	--	--	8015B	0.47	5.6
Methane	74-82-8	--	--	8015B	0.93	2.8

Footnotes:
(1) From SW-846, Test Methods for Evaluating Solid Waste.
(2) Analyte detected at a concentration above the laboratory LOD but below the laboratory LOQ will be reported and flagged as an estimated concentration. In the event that a laboratory LOD is above the respective Action Limit for that constituent, the laboratory result will be identified during the data validation process and will be specifically noted in a Data Validation Report.
(3) Limits are periodically updated by the laboratory. The current limits at the time of sample analysis will be used.

Notes:
-- No standard established.

QAPP Worksheet #15-3
Reference Limits and Evaluation (Semivolatile Organic Compounds - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs) – TARGET ANALYTE LIST (TAL)						
1,2,4-Trichlorobenzene	00120-82-1	14	70	8270C	0.87	5
1,2-Dichlorobenzene	00095-50-1	60	600	8270C	0.71	5
1,3-Dichlorobenzene	00541-73-1	120	600	8270C	0.83	5
1,4-Dichlorobenzene	00106-46-7	15	75	8270C	0.86	5
2,2'-Oxybis(1-chloropropane)	00108-60-1	--	--	8270C	0.82	5
2,4,5-Trichlorophenol	00095-95-4	--	--	8270C	1	5
2,4,6-Trichlorophenol	00088-06-2	--	--	8270C	1.07	5
2,4-Dichlorophenol	00120-83-2	--	--	8270C	1.15	5
2,4-Dimethylphenol	00105-67-9	--	--	8270C	1.13	5
2,4-Dinitrophenol	00051-28-5	--	--	8270C	2.06	10
2,4-Dinitrotoluene	00121-14-2	0.005	0.05	8270C	0.8	5
2,6-Dinitrotoluene	00606-20-2	0.005	0.05	8270C	1.07	5
2-Chloronaphthalene	00091-58-7	--	--	8270C	0.84	5
2-Chlorophenol	00095-57-8	--	--	8270C	0.7	5
2-Methylnaphthalene	00091-57-6	--	--	8270C SIM	0.00409	0.05
2-Methylphenol	00095-48-7	--	--	8270C	0.97	5
2-Nitroaniline	00088-74-4	--	--	8270C	0.84	5
2-Nitrophenol	00088-75-5	--	--	8270C	1.36	5

QAPP Worksheet #15-3 (continued)
Reference Limits and Evaluation (Semivolatile Organic Compounds - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
3 & 4-Methylphenol	00108-39-4/ 00106-44-5	--	--	8270C	0.77	5
3,3'-Dichlorobenzidine	00091-94-1	--	--	8270C	1.11	5
3-Nitroaniline	00099-09-2	--	--	8270C	0.97	5
4,6-Dinitro-2-methylphenol	00534-52-1	--	--	8270C	0.75	5
4-Bromophenyl-phenylether	00101-55-3	--	--	8270C	1.3	5
4-Chloro-3-methylphenol	00059-50-7	--	--	8270C	1.01	5
4-Chlorophenyl-phenylether	07005-72-3	--	--	8270C	1.19	5
4-Chloroaniline	00106-47-8	--	--	8270C	0.81	5
4-Nitroaniline	00100-01-6	--	--	8270C	1.1	5
4-Nitrophenol	00100-02-7	--	--	8270C	0.87	10
Acenaphthene	00083-32-9	--	--	8270C SIM	0.0048	0.05
Acenaphthylene	00208-96-8	--	--	8270C SIM	0.00382	0.05
Anthracene	00120-12-7	600	3000	8270C SIM	0.00608	0.05
Benzo(a)anthracene	00056-55-3	--	--	8270C SIM	0.00384	0.05
Benzo(a)pyrene	00050-32-8	0.02	0.2	8270C SIM	0.00303	0.05
Benzo(b)fluoranthene	00205-99-2	0.02	0.2	8270C SIM	0.003	0.05
Benzo(g,h,i)perylene	00191-24-2	--	--	8270C SIM	0.0036	0.05
Benzo(k)fluoranthene	00207-08-9	--	--	8270C SIM	0.00463	0.05
Bis(2-chloroethoxy)methane	00111-91-1	--	--	8270C	1.19	5
Bis(2-chloroethyl)ether	00111-44-4	--	--	8270C	0.66	5
Bis(2-ethylhexyl)phthalate	00117-81-7	0.6	6	8270C	2.6	5

QAPP Worksheet #15-3 (continued)
Reference Limits and Evaluation (Semivolatile Organic Compounds - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
Butylbenzylphthalate	00085-68-7	--	--	8270C	1.09	5
Carbazole	00086-74-8	--	--	8270C	0.69	5
Chrysene	00218-01-9	0.02	0.2	8270C SIM	0.00369	0.05
Dibenz(a,h)anthracene	00053-70-3	--	--	8270C SIM	0.00339	0.05
Dibenzofuran	00132-64-9	--	--	8270C	1.06	5
Diethylphthalate	00084-66-2	--	--	8270C	1.35	5
Dimethylphthalate	00131-11-3	--	--	8270C	1.04	5
di-n-Butylphthalate	00084-74-2	100	1000	8270C	0.9	5
di-n-Octylphthalate	00117-84-0	--	--	8270C	1.53	5
Fluoranthene	00206-44-0	80	400	8270C SIM	0.00467	0.05
Fluorene	00086-73-7	80	400	8270C SIM	0.00506	0.05
Hexachlorobutadiene	00087-68-3	--	--	8270C	0.66	10
Hexachlorobenzene	00118-74-1	0.1	1	8270C	1.11	5
Hexachlorocyclopentadiene	00077-47-4	--	--	8270C	1.1	5
Hexachloroethane	00067-72-1	--	--	8270C	0.58	5
Indeno(1,2,3-cd)pyrene	00193-39-5	--	--	8270C SIM	0.00496	0.05
Isophorone	00078-59-1	--	--	8270C	1.37	5
Naphthalene	00091-20-3	10	100	8270C SIM	0.00514	0.05
Nitrobenzene	00098-95-3	--	--	8270C	1.37	5
n-Nitrosodi-n-propylamine	00621-64-7	--	--	8270C	1.06	5
n-Nitrosodiphenylamine	00086-30-6	0.7	7	8270C	2.45	10

QAPP Worksheet #15-3 (continued)
Reference Limits and Evaluation (Semivolatile Organic Compounds - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
Pentachlorophenol	00087-86-5	0.1	1	8270C	1.08	10
Phenanthrene	00085-01-8	--	--	8270C SIM	0.00858	0.05
Phenol	00108-95-2	400	2000	8270C	1.03	5
Pyrene	00129-00-0	50	250	8270C SIM	0.00503	0.05
SEMIVOLATILE ORGANIC COMPOUNDS - ADDITIONAL PARAMETERS						
1,2,4,5-Tetrachlorobenzene	00095-94-3	--	--	8270D	0.776	2.5
1,2-Diphenylhydrazine	00122-66-7	--	--	8270C	1.61	5
1,4-Dioxane	00123-91-1	0.3	3.0	EPA 522 Mod.	0.067	0.2
2,5-Dinitrophenol	00329-71-5	--	--	8270D	3.935	13.124
Benzidine	00092-87-5	--	--	8270C	8.93	50
n-Nitrosodiethylamine	00055-18-5	--	--	8270D	0.974	3.25
n-Nitrosodimethylamine	00062-75-9	--	--	8270C	0.6	5
n-Nitrosodi-n-butylamine	00924-16-3	--	--	8270D	0.994	3.3
n-Nitrosopyrrolidine	00930-55-2	--	--	8270D	0.525	1.75
Pentachlorobenzene	00608-93-5	--	--	8270D	0.961	3.2

Footnotes:
(1) From SW-846, Test Methods for Evaluating Solid Waste.
(2) Analyte detected at a concentration above the laboratory LOD but below the laboratory LOQ will be reported and flagged as an estimated concentration. In the event that a laboratory LOD is above the respective Action Limit for that constituent, the laboratory result will be identified during the data validation process and will be specifically noted in a Data Validation Report.
(3) Limits are periodically updated by the laboratory. The current limits at the time of sample analysis will be used.

Notes:
-- No standard established.

QAPP Worksheet #15-4
Reference Limits and Evaluation (Pesticides/PCBs - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
POLYCHLORINATED BIPHENYLS (PCBs) TARGET ANALYTE LIST (TAL)						
Total PCBs	1336-36-3	0.003	0.03	--	--	--
Aroclor-1016	12674-11-2	--	--	8082A	0.302629	1.0
Aroclor-1221	11104-28-2	--	--	8082A	0.302629	1.0
Aroclor-1232	11141-16-5	--	--	8082A	0.302629	1.0
Aroclor-1242	53469-21-9	--	--	8082A	0.302629	1.0
Aroclor-1248	12672-29-6	--	--	8082A	0.302629	1.0
Aroclor-1254	11097-69-1	--	--	8082A	0.302629	1.0
Aroclor-1260	11096-82-5	--	--	8082A	0.302629	1.0
PESTICIDES – TARGET ANALYTE LIST (TAL)						
4,4'-DDD	00072-54-8	--	--	8081A	0.023	0.1
4,4'-DDE	00072-55-9	--	--	8081A	0.023	0.1
4,4'-DDT	00050-29-3	--	--	8081A	0.026	0.1
Aldrin	00309-00-2	--	--	8081A	0.012	0.05
Alpha-BHC	00319-84-6	--	--	8081A	0.0062	0.05
Beta-BHC	00319-85-7	--	--	8081A	0.013	0.05
Chlordane, technical	00057-74-9	0.2	2	8081A	0.18	1
Delta-BHC	00319-86-8	--	--	8081A	0.0093	0.05
Dieldrin	00060-57-1	--	--	8081A	0.018	0.1

QAPP Worksheet #15-4 (continued)
Reference Limits and Evaluation (Pesticides/PCBs - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
Endosulfan I	00959-98-8	--	--	8081A	0.011	0.05
Endosulfan II	33213-65-9	--	--	8081A	0.023	0.1
Endosulfan sulfate	01031-07-8	--	--	8081A	0.017	0.1
Endrin	00072-20-8	0.4	2	8081A	0.024	0.1
Endrin aldehyde	07421-93-4	--	--	8081A	0.019	0.1
Gamma-BHC (lindane)	00058-89-9	0.02	0.2	8081A	0.008	0.05
Heptachlor	00076-44-8	0.04	0.4	8081A	0.0091	0.05
Heptachlor epoxide	01024-57-3	0.02	0.2	8081A	0.0084	0.05
Toxaphene	08001-35-2	0.3	3	8081A	0.49	3
PESTICIDES – ADDITIONAL ANALYTES						
Methyl parathion	00298-00-0	--	--	8270D	1.055	3.52
Parathion	00056-38-2	--	--	8270D	0.919	3.064

Footnotes:
(1) From SW-846, Test Methods for Evaluating Solid Waste.
(2) Analyte detected at a concentration above the laboratory LOD but below the laboratory LOQ will be reported and flagged as an estimated concentration. In the event that a laboratory LOD is above the respective Action Limit for that constituent, the laboratory result will be identified during the data validation process and will be specifically noted in a Data Validation Report.
(3) Limits are periodically updated by the laboratory. The current limits at the time of sample analysis will be used.

Notes:
-- No standard established.
Total PCBs will be reported as the sum of all detected (above the LOD) aroclors. In the event that no aroclors are detected in a sample, the Reporting Limit for the total PCB result will be set equal to the highest LOQ of the individual aroclor.

QAPP Worksheet #15-5
Reference Limits and Evaluation (Dioxins/Furans - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
2,3,7,8-TCDD	01746-01-6	0.00003	0.000003	1613B	0.0000018	0.00001
2,3,7,8-TCDF	51207-31-9	--	--	1613B	0.0000015	0.00001

Footnotes:
(1) From SW-846, Test Methods for Evaluating Solid Waste.
(2) Analyte detected at a concentration above the laboratory LOD but below the laboratory LOQ will be reported and flagged as an estimated concentration. In the event that a laboratory LOD is above the respective Action Limit for that constituent, the laboratory result will be identified during the data validation process and will be specifically noted in a Data Validation Report.
(3) Limits are periodically updated by the laboratory. The current limits at the time of sample analysis will be used.

Notes:
-- No standard established.

QAPP Worksheet #15-6
Reference Limits and Evaluation (Metals - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
METALS – TARGET ANALYTE LIST (TAL)						
Aluminum	07429-90-5	40	200	6020A	5.042	250
Antimony	07440-36-0	1.2	6	6020A	0.134	1
Arsenic	07440-38-2	1	10	6020A	0.253	1
Barium	07440-39-3	400	2000	6020A	0.265	1
Beryllium	07440-41-7	0.4	4	6020A	0.292	1
Cadmium	07440-43-9	0.5	5	6020A	0.167	1
Calcium	07440-70-2	--	--	6020A	30.249	250
Chromium	07440-47-3	10	100	6020A	0.259	1
Cobalt	07440-48-4	8	40	6020A	0.138	1
Copper	07440-50-8	130	1300	6020A	0.329	1
Iron	07439-89-6	150	300	6020A	7.844	250
Lead	07439-92-1	1.5	15	6020A	0.29	1
Magnesium	07439-95-4	--	--	6020A	8.363	250
Manganese	07439-96-5	60	300	6020A	0.358	1

QAPP Worksheet #15-6 (continued)
Reference Limits and Evaluation (Metals - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (µg/L)	WAC CHAPTER NR 140 ES (µg/L)	LABORATORY METHOD[1]	AQUEOUS LOD[2][3] (µg/L)	AQUEOUS LOQ[2][3] (µg/L)
Mercury	07439-97-6	0.2	2	7470A	0.043	0.2
Nickel	07440-02-0	20	100	6020A	0.296	1
Potassium	07440-09-7	--	--	6020A	39.614	250
Selenium	07782-49-2	10	50	6020A	0.348	1
Silver	07440-22-4	10	50	6020A	0.127	0.5
Sodium	07440-23-5	--	--	6020A	12.545	250
Thallium	07440-28-0	0.4	2	6020A	0.387	1
Vanadium	07440-62-2	6	30	6020A	0.378	1
Zinc	07440-66-6	2500	5000	6020A	1.52	10

Footnotes:
(1) From SW-846, Test Methods for Evaluating Solid Waste.
(2) Analyte detected at a concentration above the laboratory LOD but below the laboratory LOQ will be reported and flagged as an estimated concentration. In the event that a laboratory LOD is above the respective Action Limit for that constituent, the laboratory result will be identified during the data validation process and will be specifically noted in a Data Validation Report.
(3) Limits are periodically updated by the laboratory. The current limits at the time of sample analysis will be used.

Notes:
-- No standard established.

QAPP Worksheet #15-7
Reference Limits and Evaluation (Wet Chemistry - Water)

PARAMETER	CHEMICAL ABSTRACT SERVICE NUMBER	WAC CHAPTER NR 140 PAL (mg/L)	WAC CHAPTER NR 140 ES (mg/L)	LABORATORY METHOD	AQUEOUS LOD[2][3] (mg/L)	AQUEOUS LOQ[2][3] (mg/L)
Alkalinity as $CaCO_3$	--	--	--	SM 2320B	1.8	10
BOD	--	--	--	SM 5210B-01	2	2
Chloride	16887-00-6	125	250	EPA 300.0	2	4
Cyanide, amenable	00057-12-5A	--	--	EPA 335.4	0.008	0.25
Cyanide, total	00057-12-5T	40	200	EPA 335.4	0.00612	0.02
Hardness as $CaCO_3$	--	--	--	6020A[1]	0.005	0.005
Nitrogen, ammonia	1336-21-6	0.97	9.7	EPA 350.1	0.212	0.424
Nitrogen, nitrate + nitrite	--	2	10	EPA 353.2	0.125	0.25
Phosphorus	07723-14-0T	--	--	EPA 365.4	0.20	0.4
Solids, total suspended	--	--	--	SM 2540D	1.54	10.0
Sulfate	14808-79-8	125	250	EPA 300.0	2	4
Chromium, hexavalent	18540-29-9	--	--	7196A[1]	3.4	20

Footnotes:
(1) From SW-846, Test Methods for Evaluating Solid Waste.
(2) Analyte detected at a concentration above the laboratory LOD but below the laboratory LOQ will be reported and flagged as an estimated concentration. In the event that a laboratory LOD is above the respective Action Limit for that constituent, the laboratory result will be identified during the data validation process and will be specifically noted in a Data Validation Report.
(3) Limits are periodically updated by the laboratory. The current limits at the time of sample analysis will be used.

Notes:
– No standard established.

QAPP Worksheet #16-1
Project Schedule/Timeline
(Long Term Monitoring)

ACTIVITIES	ORGANIZATION	DATES (MM/DD/YY)		DELIVERABLE	DELIVERABLE DUE DATE
		ANTICIPATED DATE(S) OF INITIATION	ANTICIPATED DATE OF COMPLETION		
Groundwater Monitoring and Analysis	LSRG	Q2/2011 (June)	To be determined	Quarterly Data Transmittals	75 days following receipt of final Level IV data packages
Groundwater Extraction System Operational Status Check	LSRG	Q3/2011 (July)	To be determined	Quarterly Discharge Monitoring Reports (DMRs)	75 days following receipt of final Level IV data packages
Leachate Monitoring	LSRG	To be determined[1]	To be determined	Transmittal to Heart of the Valley Municipal Sewerage District	Annually; based on system operation schedule
Landfill Gas Monitoring (LTR site)	LSRG	Q4 (November)	To be determined	Annual Observation and Monitoring Progress Report	Annually in December following the reporting period (July through June)
Electronic Data Deliverables (EDDs)	LSRG	Ongoing	To be determined	Quarterly EDD (containing all of the data listed above)	Schedule governed by the groundwater monitoring schedule; 75 days following receipt of final Level IV data packages for given quarter

Footnotes:

[1] Leachate monitoring will be performed only when the leachate extraction system is in operation.

QAPP Worksheet #16-2
Project Schedule/Timeline
(Groundwater Monitoring Well Installation)

ACTIVITIES	ORGANIZATION	DATES (MM/DD/YY)		DELIVERABLE	DELIVERABLE DUE DATE
		ANTICIPATED DATE(S) OF INITIATION	ANTICIPATED DATE OF COMPLETION		
Field work	LSRG	To be determined (2012)	To be determined (2012)	Per GMP (TRC, 2011a) and Sampling and Analysis Plan (TRC, 2011b)	2012
O&M Progress Report	LSRG	August 2012	December 2012	O&M Progress Report	December 2012

QAPP Worksheet #17-1
Sampling Design and Rationale (Long Term Monitoring)

Describe and provide a rationale for choosing the sampling approach (*e.g.*, grid system, biased statistical approach):

The groundwater sampling program rationale is described in detail in the "Groundwater Monitoring Plan, Lemberger Landfill and Lemberger Transport and Recycling Site" – September 2011 (TRC, 2011a)

The groundwater extraction system operation status check program rationale is to demonstrate that the groundwater treatment system is maintained in operational condition. The system is operated once per quarter, and the system effluent is analyzed and compared to WPDES permit requirements. Compliance with the permit requirements indicates the system has been maintained in operational condition.

Leachate monitoring will be performed on a quarterly basis during system operation to demonstrate concentrations of contaminants are within the acceptance limits of the WWTP.

Gas monitoring will be performed annually at the LTR site to demonstrate that landfill gas is not building up beneath, nor migrating from, the LTR site. Data collected from the gas vents and probes will consist of field measurements. No samples will be collected for laboratory analysis.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations):

All analytical samples are an aqueous matrix (groundwater, treated effluent, and leachate). Each monitoring task is performed on a quarterly basis, with analytical and scope modifications based on Quarterly, Semiannual, and Annual programs. Analytes include VOCs, SVOCs, PCBs, PAHs, pesticides, metals, wet chemistry indicator parameters, and dioxins/furans (leachate and effluent only). The analytical program for each of the monitoring tasks is summarized in Attachment 1 of this QAPP; QC sample requirements are summarized in Worksheet 20.

QAPP Worksheet #17-2
Sampling Design and Rationale (Groundwater Monitoring Well Installation)

Describe and provide a rationale for choosing the sampling approach (*e.g.*, grid system, biased statistical approach):

The sampling program rationale is described in the "Groundwater Monitoring Plan, Lemberger Landfill and Lemberger Transport and Recycling Site" – September 2011 (TRC, 2011a).

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations):

Sampling program implementation details are described in the SAP (TRC, 2011b).

QAPP Worksheet #18-1
Sampling Locations and Methods/SOP Requirements
Long Term Monitoring

SAMPLING LOCATION/ID NUMBER	MATRIX	ANALYTICAL GROUP[1]	CONCENTRATION LEVEL	NUMBER OF SAMPLES[2] (Identify field duplicates)	SAMPLING SOP REFERENCE[3]	RATIONALE FOR SAMPLING LOCATIONS
LTR Sentinel Wells: RM-2I, RM-2D, RM-3XD, RM-203D, RM-210D, RM-211D, RM-212D, RM-401XD, RM-401XXD	Water	Quarterly: VOCs, field parameters Annual: VOCs, SVOCs, 1,4-dioxane[4], PCBs[4], metals, alkalinity, chloride, cyanide, nitrate, sulfate, field parameters	Normal	One grab sample per well location, per quarter (March, June, September, December)	F-1	Sample locations chosen to document extent of plume, and demonstrate plume stability. Samples for geochemical data to verify MNA. RM-401XD/XXD may be moved to semiannual monitoring after 2 years.
LTR Plume Wells Group S: RM-3D, RM-5D, RM-7XD, RM-7XXD, RM-8D, RM-101D, RM-203D, RM-204D, RM-208D, RM-208XD, RM-209D, RM-303D, RM-306D, RM-307D, RM-401D	Water	Semiannually: VOCs, methane, field parameters Annually: VOCs, methane, SVOCs, 1,4-dioxane[4], pesticides, PCBs[4], metals, alkalinity, chloride, nitrate, sulfate, field parameters	Normal	One grab sample per well location, per event (Semiannual – March/September)	F-1	Sample locations chosen to allow confirmation of plume dimensions laterally and vertically. Samples for geochemical data to verify MNA. Sufficient historical data are available to show seasonal variability

QAPP Worksheet #18-1 (continued)
Sampling Locations and Methods/SOP Requirements
Long Term Monitoring

SAMPLING LOCATION/ID NUMBER	MATRIX	ANALYTICAL GROUP[1]	CONCENTRATION LEVEL	NUMBER OF SAMPLES[2] (Identify field duplicates)	SAMPLING SOP REFERENCE[3]	RATIONALE FOR SAMPLING LOCATIONS
LTR Plume Wells Group A: RM-1D, RM-3I, RM-4D, RM-5I, RM-7S, RM-7D, RM-10D, RM-101I, RM-103D, RM-102D, RM-202D, RM-203I, RM-204I, RM-208I, RM-210I, RM-212I, RM-213D, RM-214D, RM-304D, RM-305D, RM-308D, EW-01D, EW-03D, EW-04D, EW-6D, EW-07D	Water	Annually: VOCs, methane, PAHs[4], PCP[4], BEHP[4], 1,4-dioxane[4], PCBs[4] iron, manganese, alkalinity, chloride, nitrate, sulfate, field parameters	Normal	One grab sample per well location, per event (Annual - September)	F-1	Sample locations chosen to allow confirmation of plume dimensions laterally and vertically. Samples for geochemical data to verify MNA. Sufficient historical data are available to show seasonal variability.
LL Wells: RM-5S, RM-206S, RM-207S, RM-208S, RM-301S, RM-302S	Water	Annually: VOCs, 1,4-dioxane[4], field parameters	Normal	One grab sample per well, per event (Annual - September).	F-1	Sample locations chosen to monitor shallow aquifer adjacent to the LL. Gross changes in aquifer geochemistry monitored with field parameters.
Residential Wells Group S: GR-8, GR-9, GR-10, GR-11, GR-12, GR-13, GR-14, GR-15, GR-17, GR-25, GR-26, GR-27, GR-62, GR-63, GR-64, GR-66	Water	Semiannually: VOCs, PAHs[4], PCP[4], BEHP[4], 1,4-dioxane[4], PCBs[4], field parameters	Normal	One grab sample per well, per event (Semiannual – March/September)	F-1	Demonstrate protectiveness of residential water supply wells. Group S private wells generally correspond to those that fall within the portion of the NR 812.09 "special casing requirement" area.

QAPP Worksheet #18-1 (continued)
Sampling Locations and Methods/SOP Requirements
Long Term Monitoring

SAMPLING LOCATION/ID NUMBER	MATRIX	ANALYTICAL GROUP[1]	CONCENTRATION LEVEL	NUMBER OF SAMPLES[2] (Identify field duplicates)	SAMPLING SOP REFERENCE[3]	RATIONALE FOR SAMPLING LOCATIONS
Residential Wells Group A: GR-16, GR-24, GR-30, GR-60R, GR-65, GR-67, GR-68, GR-69, GR-70, GR-71, GR-72	Water	Annually: VOCs, PAHs[4], PCP[4], BEHP[4], 1,4-dioxane[4], PCBs[4], field parameters	Normal	One grab sample per well, per event (Annual - September)	F-1	Demonstrate protectiveness of residential water supply wells
All existing site monitoring, observation, extraction (EW and LW), and leachate head (LH) wells[4]	Water	None	Not applicable	Existing wells will be monitored for water level Semiannually (March/September) (QA/QC samples are not applicable)	F-1	Water levels to be measured to define groundwater flow conditions across entire LL and LTR sites Water levels monitored at LL to determine whether leachate is within the waste and to assess the potential for constituents in leachate to migrate to shallow and deep groundwater flow systems.
Effluent	Water	Quarterly: VOCs, metals, inorganic indicators, field parameters Annually: VOCs, SVOCs, 1,4-dioxane[4], Pesticides, PCBs, dioxin, furan, metals, inorganic indicators, field parameters	Normal	One grab sample from treatment system following operation cycle. (Quarterly – January, April, July, October) No duplicate samples will be collected from the treated effluent.	F-1, meter calibration, field measurements, and sample handling	To demonstrate the operational status of the groundwater treatment system.

QAPP Worksheet #18-1 (continued)
Sampling Locations and Methods/SOP Requirements
Long Term Monitoring

SAMPLING LOCATION/ID NUMBER	MATRIX	ANALYTICAL GROUP[1]	CONCENTRATION LEVEL	NUMBER OF SAMPLES[2] (Identify field duplicates)	SAMPLING SOP REFERENCE[3]	RATIONALE FOR SAMPLING LOCATIONS
Leachate	Water	Quarterly (if system is running): Metals, inorganic indicator parameters, field parameters Annually (if system is running): VOCs, SVOCs, 1,4-dioxane[4], pesticides, PCBs, dioxin, furan, metals, inorganic indicators, field parameters	Normal	One grab sample from the leachate tank, quarterly when system is in operation. No field duplicates will be collected from the leachate.	F-1, meter calibration, field measurements, and sample handling	Sample collected from leachate tank for leachate disposal purposes.
Leachate Head Wells; Leacahte Extraction Wells (LL) LH-1 through LH-7 LW-1 through LW-8 MW-14R and MW-15R	Water	To be determined; as required by USEPA and WDNR.	Normal	One grab sample from each sample point, if water is present, schedule as required by USEPA and WDNR.	F-1	Samples collected periodically to assess leachate strength

QAPP Worksheet #18-1 (continued)
Sampling Locations and Methods/SOP Requirements
Long Term Monitoring

SAMPLING LOCATION/ID NUMBER	MATRIX	ANALYTICAL GROUP[1]	CONCENTRATION LEVEL	NUMBER OF SAMPLES[2] (Identify field duplicates)	SAMPLING SOP REFERENCE[3]	RATIONALE FOR SAMPLING LOCATIONS
Landfill Gas Probes and Vents: GP-1 through GP-6 GV-1 through GV-36	Gas	field parameters	Normal	One grab sample from each sample point, annually. (November)	F-7	Samples collected to demonstrate no buildup or migration of gas within the LTR.

Footnotes:
(1) The parameter group "SVOCs" refers to the Target Analyte List (TAL), which includes PCP, BEHP, and the subgroup PAHs. 1,4-dioxane is an SVOC; however, as it is analyzed by a separate method (8270D-SIM) it is not included in the SVOC TAL. 1,4 dioxane will be analyzed where indicated.

(2) Field duplicates will be collected at a frequency of one duplicate for every 10 (or fewer) groundwater samples (Worksheet #20). The duplicate sample count will be based on the total number of groundwater samples collected during the monitoring period. No duplicate samples will be collected for effluent, leachate, or gas monitoring samples.

(3) See project Sampling SOP References table (Worksheet #21).

(3) Parameter (or parameter group) will be sampled and analyzed for over two consecutive annual rounds (September 2012 and 2013 events only) using lower method detection limits, if possible.

(5) Water level monitoring network wells identified in the Groundwater Monitoring Plan (TRC, 2011a).

QAPP Worksheet #18-2
Sampling Locations and Methods/SOP Requirements
(Groundwater Monitoring Well Installation)

SAMPLING LOCATION/ID NUMBER	MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	NUMBER OF SAMPLES (identify field duplicates)	SAMPLING SOP REFERENCE	RATIONALE FOR SAMPLING LOCATIONS
RM-003XD, RM-401XXD; depth intervals to be determined[1]	Soil/Rock, Water	▪ Geologic characterization (soil/rock, geophysical logging) ▪ VOCs, field parameters[2] - discrete interval sampling (water)	Normal	Primary samples are defined in the SAP (TRC, 2011b)[3]	Defined in the SAP (TRC, 2011b)	Defined in the GMP (TRC, 2011a) and the SAP (TRC, 2011b)

Footnotes:
(1) Sampling locations and intervals are defined in the SAP (TRC, 2011b).
(2) Field parameters include field measurements of oxidation-reduction potential (ORP), dissolved oxygen, pH, specific conductance, and temperature
(3) Field duplicates will be collected at a frequency of one duplicate for every 10 (or fewer) primary groundwater samples (Worksheet #20). The duplicate sample count will be based on the total number of groundwater samples collected during the monitoring well installation.

QAPP Worksheet #19
Analytical SOP Requirements

MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	ANALYTICAL AND PREPARATION METHOD/SOP REFERENCE[1]	SAMPLE VOLUME[2]	CONTAINERS (number, size, and type)	PRESERVATION REQUIREMENTS (chemical, temperature, light protected)	MAXIMUM HOLDING TIME (preparation/ analysis)
Water	VOC (Monitoring Wells)	All	▪ Pace 01 (SW-846 8260B)	120 mL	(3) 40-mL glass vials, no headspace	Cool to 4 ± 2 °C HCl to pH <2	14 days
Water	VOC (Residential Wells)	All	▪ Pace 01 (SW-846 8260B)	120 mL	(3) 40-mL glass vials, no headspace	Cool to 4 ± 2 °C (unpreserved)	7 days
Water	Vinyl chloride	Low level	▪ Pace 24 (SW-846 8260C)	120 µg/L	(3) 40-mL glass vials, no headspace	Cool to 4 ± 2 °C HCl to pH <2	14 days
Water	Dissolved gases	All	▪ Pace 06 (SW-846 5021 prep; SW-846 8015B analysis)	120 mL	(3) 40-mL glass vials	Cool to 4 ± 2 °C may be preserved with HCL to pH <2 (not required)	14 days
Water	SVOC (TAL)	All	▪ Pace 17 (Separatory Funnel Ext) ▪ Pace 02 (SW-846 8270C)	1000 mL	(1) 1-L amber glass	Cool to 4 ± 2 °C	7 days to extraction; 40 days to analyze
Water	SVOC (PAH)	All	▪ Pace 17 (Separatory Funnel Ext) ▪ Pace 03 (SW-846 8270C-SIM)	1000 mL	(1) 1-L amber glass	Cool to 4 ± 2 °C	7 days to extraction; 40 days to analyze

QAPP Worksheet #19 (continued)
Analytical SOP Requirements

MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	ANALYTICAL AND PREPARATION METHOD/SOP REFERENCE[1]	SAMPLE VOLUME[2]	CONTAINERS (number, size, and type)	PRESERVATION REQUIREMENTS (chemical, temperature, light protected)	MAXIMUM HOLDING TIME (preparation/ analysis)
Water	PCB	All	▪ Pace 17 (Separatory Funnel Ext) ▪ Pace 04 (SW-846 8082A)	1000 mL	(1) 1-L amber glass	Cool to 4 ± 2 °C	7 days to extraction; 40 days to analyze
Water	Pesticides	All	▪ Pace 17 (Separatory Funnel Ext) ▪ Pace 05 (SW-846 8081A)	1000 mL	(1) 1-L amber glass	Cool to 4 ± 2 °C	7 days to extraction; 40 days to analyze
Water	Pesticides/SVOCs by method 8270D	All	▪ Pace 21 (NLS) (SW-846 8270D)	1000 mL	(1) 1-L amber glass	Cool to 4 ± 2 °C	7 days to extraction; 40 days to analyze
Water	1,4-Dioxane	All	▪ Pace 23 (TA-VT) (EPA 522 Mod.)	1000 mL	(1) 1-L amber glass	Cool to 4 ± 2 °C HCl to pH <2	28 days to extraction; 28 days to analyze
Water	Dioxins/Furans	All	▪ Pace 07 (EPA Method 1613B)	1000 mL	(1) 1-L amber glass	Cool to 4 ± 2 °C	30 days to extraction; 40 days to analyze
Water	Metals (except Hg)	All	▪ Pace 08 (SW-846 6020A)	30 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C HNO_3 to pH <2	6 months
Water	Metals (mercury)	All	▪ Pace 09 (SW-846 7470A)	250 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C HNO_3 to pH <2	28 days
Water	Alkalinity	All	▪ Pace 15 (SM 2320B)	100 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C	14 days
Water	Chloride	All	▪ Pace 16 (EPA 300.0)	60 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C	28 days

QAPP Worksheet #19 (continued)
Analytical SOP Requirements

MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	ANALYTICAL AND PREPARATION METHOD/SOP REFERENCE[1]	SAMPLE VOLUME[2]	CONTAINERS (number, size, and type)	PRESERVATION REQUIREMENTS (chemical, temperature, light protected)	MAXIMUM HOLDING TIME (preparation/ analysis)
Water	Sulfate	All	▪ Pace 16 (EPA 300.0)	60 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C	28 days
Water	Nitrate+Nitrite	All	▪ Pace 13 (EPA 353.2)	60 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C H_2SO_4 to pH <2	28 days
Water	Ammonia	All	▪ Pace 12 (EPA 350.1)	60 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C H_2SO_4 to pH <2	28 days
Water	Cyanide, Total	All	▪ Pace 11 (EPA 335.4)	60 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C NaOH to pH >12	14 days
Water	Cyanide, Total and Amenable	All	▪ Pace 20 (BL) (EPA 335.4)	60 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C NaOH to pH >12	14 days
Water	Total Suspended Solids	All	▪ Pace 19 (SM 2540D)	500 mL	(1) 1000 mL HDPE	Cool to 4 ± 2 °C	7 days
Water	Biological Oxygen Demand (BOD)	All	▪ Pace 18 (SM 5210B)	600 mL	(1) 1000 mL HDPE	Cool to 4 ± 2 °C	48 hours
Water	Total Phosphorus	All	▪ Pace 14 (EPA 365.4)	60 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C H_2SO_4 to pH <2	28 days
Water	Hardness	All	▪ Pace 08 (SW-846 6020A)	150 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C HNO_3 to pH <2	6 months
Water	Hexavalent Chromium	All	▪ Pace 10 (SM 3500)	40 mL	(1) 250 mL HDPE	Cool to 4 ± 2 °C	24 hours

Footnote:
(1) Reference number from QAPP Worksheet #23.
(2) The sample volume represents a recommended minimum volume. Additional sample volume may be requested by the laboratory in case of breakage. Sample volume for multiple analyses may be combined into a single jar of adequate volume.

QAPP Worksheet #20
Field Quality Control Sample Summary

MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	ANALYTICAL AND PREPARATION SOP REFERENCE[1]	NUMBER OF SAMPLING LOCATIONS[2]	NUMBER OF FIELD DUPLICATE PAIRS	MATRIX SPIKES	NUMBER OF FIELD BLANKS[3]	NUMBER OF EQUIPMENT BLANKS[3]	TOTAL NUMBER OF SAMPLES TO LABORATORY[2]
Water	VOCs	All	Pace 01	TBD	1/10	1/20	1/10	1/10	TBD
Water	Dissolved Gases	All	Pace 06	TBD	1/10	1/20	1/10	1/10	TBD
Water	SVOC (TAL)	All	Pace 17, Pace 02	TBD	1/10	1/20	1/10	1/10	TBD
Water	SVOC (PAH)	All	Pace 17, Pace 03	TBD	1/10	1/20	1/10	1/10	TBD
Water	SVOC (1,4-dioxane)	All	Pace 23	TBD	1/10	1/20	1/10	1/10	TBD
Water	PCBs	All	Pace 17, Pace 04	TBD	1/10	1/20	1/10	1/10	TBD
Water	Pesticides	All	Pace 17, Pace 05	TBD	1/10	1/20	1/10	1/10	TBD
Water	Pesticides/SVOCs by method 8270D	All	Pace 21 (NLS)	TBD	1/10	1/20	1/10	1/10	TBD
Water	Dioxins/Furans	All	Pace 07	TBD	1/10	1/20	1/10	1/10	TBD
Water	Metals (except Hg)	All	Pace 08	TBD	1/10	1/20	1/10	1/10	TBD
Water	Metals (mercury)	All	Pace 09	TBD	1/10	1/20	1/10	1/10	TBD
Water	Alkalinity	All	Pace 15	TBD	1/10	1/20	1/10	1/10	TBD
Water	Chloride	All	Pace 16	TBD	1/10	1/20	1/10	1/10	TBD
Water	Sulfate	All	Pace 16	TBD	1/10	1/20	1/10	1/10	TBD

QAPP Worksheet #20 (continued)
Field Quality Control Sample Summary

MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	ANALYTICAL AND PREPARATION SOP REFERENCE[1]	NUMBER OF SAMPLING LOCATIONS[2]	NUMBER OF FIELD DUPLICATE PAIRS	MATRIX SPIKES	NUMBER OF FIELD BLANKS[3]	NUMBER OF EQUIPMENT BLANKS[3]	TOTAL NUMBER OF SAMPLES TO LABORATORY[2]
Water	Nitrate+Nitrite	All	Pace 13	TBD	1/10	1/20	1/10	1/10	TBD
Water	Nitrate	All	Pace 16	TBD	1/10	1/20	1/10	1/10	TBD
Water	Nitrite	All	Pace 16	TBD	1/10	1/20	1/10	1/10	TBD
Water	Ammonia	All	Pace 12	TBD	1/10	1/20	1/10	1/10	TBD
Water	Cyanide, Total	All	Pace 11	TBD	1/10	1/20	1/10	1/10	TBD
Water	Cyanide, Total & Amenable	All	Pace 20 (BL)	TBD	1/10	1/20	1/10	1/10	TBD
Water	Total Suspended Solids	All	Pace 19	TBD	1/10	1/20	1/10	1/10	TBD
Water	Biological Oxygen Demand	All	Pace 18	TBD	1/10	1/20	1/10	1/10	TBD
Water	Total Phosphorus	All	Pace 14	TBD	1/10	1/20	1/10	1/10	TBD
Water	Hardness	All	Pace 08	TBD	1/10	1/20	1/10	1/10	TBD

Footnotes:
(1) See Analytical SOP Reference Table (Worksheet #23).
(2) See project specific Sampling and Analysis Plan for planned numbers of samples.
(3) Field and equipment blanks will be collected at the specified frequency only when non-disposable and non-dedicated sampling equipment is used.

QAPP Worksheet #21
Project Sampling SOP Reference

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	ORIGINATING ORGANIZATION	EQUIPMENT TYPE	MODIFIED FOR PROJECT WORK? (Y/N)	COMMENTS
F-1	Groundwater Sampling and Field Measurement Procedures	TRC	Bladder pump, submersible electric pump (or equivalent), HDPE/LDPE tubing, Geotech P3 flow through cell (or equivalent), appropriate sample containers	Y	Type of pump (or bailer) used will depend on depth to water and well hydraulics at each well
F-2	Landfill Gas Monitoring	TRC	Multi-gas meter	Y	
F-3	Example Field Forms	TRC	NA	Y	

Note:
Field sampling SOPs for the LTMP are included in Attachment 2. Field sampling SOPs for other sampling tasks are included in the project-specific SAPs.

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection

FIELD EQUIPMENT	CALIBRATION ACTIVITY	MAINTENANCE ACTIVITY	TESTING ACTIVITY	INSPECTION ACTIVITY	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	RESPONSIBLE PERSON	SOP REFERENCE[1]
Water Level Meter	Per manufacturer's specifications	Per manufacturer's specifications	Water levels	Check probe response Check tape for wear	Daily	Probe is responsive Tape is legible and intact.	Battery replacement Tape will be replaced when worn	TRC On-Site Coordinator	F-1
Flow-through cell and sampling meters	Per manufacturer's specifications.	Per manufacturer's specifications; battery changing	Field measurements of temperature, redox potential, dissolved oxygen, specific conductance, and pH	Check probe response	Daily	Meters must power up; probes are responsive. pH, specific conductance redox must calibrate to standard solutions w/in manufacturers specs	Replace unresponsive probes or meters Recalibrate meters as needed	TRC On-Site Coordinator	F-1
Hach 2100P turbidity meter (or equivalent)	Per manufacturer's specifications	Per manufacturer's specifications; battery changing	Field turbidity measurements	Check sample device	Daily	Meter must calibrate to standard solutions within manufacturer's specifications	Replace unresponsive meter; replace meters that will not calibrate	TRC On-Site Coordinator	F-1
Bladder pump; Submersible electric pumps	Per manufacturer's specifications	Per manufacturer's specifications	Water sample collection	Check pump function	Daily	Pump produces water	Replace inoperable pumps	TRC On-Site Coordinator	F-1

QAPP Worksheet #22 (continued)
Field Equipment Calibration, Maintenance, Testing, and Inspection

FIELD EQUIPMENT	CALIBRATION ACTIVITY	MAINTENANCE ACTIVITY	TESTING ACTIVITY	INSPECTION ACTIVITY	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	RESPONSIBLE PERSON	SOP REFERENCE[1]
Multi-gas meter	Per manufacturer's specifications	Per manufacturer's specifications	Landfill gas monitoring	Check meter response	Daily	Meter is responsive, and calibrates to standard gas within manufacturer's specifications	Recalibrate meter Replace meters that will not calibrate	TRC On-Site Coordinator	F-2

Footnote:
(1) See project Sampling SOP References table (Worksheet #21).

Note:
NA = not applicable.

QAPP Worksheet #23
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
Pace 01	Determination of Volatile Organics by GC/MS; SW-846 method 8260B w/ 5030B	Definitive	VOC	GC/MS	Pace	N	No
Pace 02	Determination of Semi-Volatile Organics by GC/MS; SW-846 Method 8270C	Definitive	SVOC	GC/MS	Pace	N	No
Pace 03	Determination of Semi-Volatile Organics by GC/MS; SW-846 Method 8270C (Selective Ion Monitoring)	Definitive	SVOC	GC/MS	Pace	N	No
Pace 04	Analysis of Polychlorinated Biphenyls (PCBs) by Gas Chromatography; SW-846 Method 8082A	Definitive	PCB	GC/ECD	Pace	N	No
Pace 05	Analysis of Organochlorine Pesticides by Gas Chromatography; SW-846 Method 8081A	Definitive	Organochlorine pesticides	GC/ECD	Pace	N	No
Pace 06	Analysis of Dissolved Methane, Ethane, and Ethene in Groundwater by Static Headspace and Gas Chromatography; SW-846 8015B	Definitive	Methane, ethane, ethene	GC/FID	Pace	N	No

QAPP Worksheet #23 (continued)
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
Pace 07	Preparation and Analysis of Samples for the Determination of Dioxins and Furans; EPA Method 1613B	Definitive	Dioxin/furans	GC/HRMS	Pace	N	No
Pace 08	Determination of Trace Metals in Waters and Wastes By Inductively Coupled Plasma Mass Spectroscopy; SW-846 Method 6020A	Definitive	Metals (except Hg)	ICP/MS	Pace	N	No
Pace 09	The Determination of Mercury by Cold Vapor Atomic Absorption Spectroscopy; SW-846 Method 7470A	Definitive	Mercury (Hg)	CVAA	Pace	N	No
Pace 10	Chromium, Hexavalent – Colorimetric; SM 3500 CR-B-01	Definitive	Hexavalent chromium	Visible spectrophotometer	Pace	N	No
Pace 11	Total Cyanide using Micro-Distillation and SmartChem; SW-846 Method 9012A	Definitive	Total cyanide	Visible spectrophotometer	Pace	N	No
Pace 12	Ammonia using Micro-Distillation and Analyzed by Lachat 8000 Flow Injection; EPA Method 350.1	Definitive	Ammonia	Automated visible spectrophotometer	Pace	N	No

QAPP Worksheet #23 (continued)
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
Pace 13	Nitrate and Nitrite using Micro-Distillation and Analyzed by Lachat 8000 Flow Injection; EPA Method 353.2	Definitive	Nitrate, nitrite	Automated visible spectrophotometer	Pace	N	No
Pace 14	Total Phosphorus using Block Digestion and Analyzed by SmartChem, EPA Method 365.4	Definitive	Total phosphorus	Visible spectrophotometer	Pace	N	No
Pace 15	Alkalinity, SM 2320B	Definitive	Alkalinity	pH meter	Pace	N	No
Pace 16	Ion Chromatography	Definitive	Nitrate, nitrite, chloride, sulfate	Ion chromatograph	Pace	N	No
Pace 17	Separatory Funnel Extraction	Definitive	Extractable organics	Not applicable	Pace	N	No
Pace 18	Biochemical Oxygen Demand	Definitive	BOD	Dissolved oxygen meter	Pace	N	No
Pace 19	Measurement of Volatile Solids and Solids in Waters	Definitive	Total suspended solids	Balance	Pace	N	No
Pace 20	Cyanides Amenable to Chlorination after Distillation	Definitive	Amenable cyanide	Visible spectrophotometer	Badger Labs (subcontract)	N	No

QAPP Worksheet #23 (continued)
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
Pace 21	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Definitive	Organophosphate pesticides/SVOCs	GC/MS	NLS (subcontract)	N	No
Pace 22	Preventative, Routine, and Non-routine Maintenance	Not applicable	All	All	Pace	N	No
Pace 23	1,4-Dioxane in water by GC/MS/SIM	Definitive	1,4-Dioxane (SVOC)	GC/MS	TestAmerica-VT (Subcontract)	N	No
Pace 24	Analysis of Volatile Organic Compounds by GC/MS	Definitive	Vinyl Chloride	GC/MS	CT Laboratories (subcontract)	N	No

Notes:
Analytical SOPs are include in Attachment 4

QAPP Worksheet #24
Analytical Instrument Calibration

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION CHECKS	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA	SOP REFERENCE[1]
GC/MS	Tuning	Before 12 hour sample analysis	Method criteria	Inspect the instrument, correct the problems, and re-tune.	Analyst	Pace 01 Pace 02 Pace 24
	ICAL: see SOPs.	CCV and tune are analyzed within 12-hr window	Varies, see SOPs.	Inspect the instrument, correct the problems, and recalibrate.	Analyst	
GC/MS (SIM)	Tuning	Before 12 hour sample analysis	Verification of the alignment of the mass spectral axis.	Inspect the instrument, correct the problems, and re-tune.	Analyst	Pace 3 Pace 23
	ICAL: see SOPs.	CCV and tune are analyzed within 12-hr window	Varies, see SOPs.	Inspect the instrument, correct the problems, recalibrate.	Analyst	
GC/ECD	Response Factors	CCV is analyzed after every 10 samples and the end of sequence.	ICAL: RSD of ≤ 20% CCV : ± 20 %	Inspect system, correct problem, and recalibrate.	Analyst	Pace 04
GC/ECD	Linear Regression or Response Factors	CCV and PEM are analyzed every 20 samples or less and the end of the sequence.	ICAL: r^2 >.99; or RSD of ≤ 20% CCV : ± 20 % PEM: ≤ 15 %	Inspect the instrument, correct the problems, and recalibrate.	Analyst	Pace 05
GC/FID	Linear Regression	CCV is analyzed after every 10 samples and the end of sequence.	ICAL: r2 >.99 CCV : ± 15 %	Inspect the instrument, correct the problems, and recalibrate.	Analyst	Pace 06

QAPP Worksheet #24 (continued)
Analytical Instrument Calibration

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION CHECKS	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA	SOP REFERENCE[1]
GC/HRMS	Mass Resolution	Before 12 hour sample analysis	Resolution ≥10,000	Inspect the instrument, correct the problems, and re-tune.	Analyst	Pace 07
	Column Resolution	Daily	2,3,7,8-TCDD valley ≤ 20%	Inspect the instrument, correct the problems, and recalibrate		
	ICAL: Response Factors	12-hr	ICAL: RSD of ≤ 20% CCV : ± 20 %	Inspect the instrument, correct the problems, and recalibrate		
ICP/MS	Tuning	12-hr	See Pace-08	Inspect the instrument, correct the problems, and re-tune.	Analyst	Pace 08
	ICAL: Linear Regression	CCV is analyzed after every 10 samples and the end of sequence	ICAL: r2 >.998 CCV : ± 10 %	Inspect the instrument, correct the problems, and recalibrate.		
CVAA	Linear Regression	CCV is analyzed after every 10 samples and the end of sequence	ICAL: r2 >.995 CCV : ± 10 %	Inspect the instrument, correct the problems, and recalibrate.	Analyst	Pace 06
Visible Spectrophotometer	Linear Regression	CCV is analyzed after every 10 samples and the end of sequence	ICAL: r2 >.995 CCV : ± 10 %	Inspect the instrument, correct the problems, and recalibrate.	Analyst	Pace 10; Pace 11; Pace 12; Pace 13; Pace 14
pH Meter	See Pace-15	pH 7.0 CCV is analyzed after every 10 samples and the end of sequence	See Pace-015	Inspect the instrument, correct the problems, and recalibrate.	Analyst	Pace 15

QAPP Worksheet #24 (continued)
Analytical Instrument Calibration

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION CHECKS	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA	SOP REFERENCE[1]
Ion Chromatograph	Linear Regression	CCV is analyzed after every 10 samples and the end of sequence	ICAL: r2 >.995 CCV : ± 10 %	Inspect the instrument, correct the problems, and recalibrate.	Analyst	Pace 16
Dissolved Oxygen Meter	Follow Instruction in operator's manual	Follow Instruction in operator's manual	Follow Instruction in operator's manual	Inspect the instrument, correct the problems, and recalibrate.	Analyst	Pace 18

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection

INSTRUMENT/ EQUIPMENT	MAINTENANCE ACTIVITY	TESTING ACTIVITY	INSPECTION ACTIVITY	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	RESPONSIBLE PERSON	SOP REFERENCE[1]
GC	Change septum. Clean injection port. Check and replace liner. Clip or replace column. Condition column. Replace gas filter.	None specified	Fill wash vials. Check gas pressures on tanks. Check injector needle.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 22 Pace 02 Pace 03 Pace 04 Pace 05 Pace 06 Pace 07 Pace 23 Pace 24
ECD	Condition at 300°C for a minimum of 24 hrs.	Conduct leak test.	None specified	Per instrument setup	Acceptable signal	None specified	Analyst	Pace 04 Pace 05
FID	Condition at 300°C for a minimum of 24 hrs. Clean with wire brush.	None specified	None specified	Per instrument setup	Acceptable signal	None specified	Analyst	Pace 06
MS (Mass Spectrometer)	Clean source. Replace electron multiplier. Replace filament. Replace turbo pump oil.	None specified	Check gas pressures on tanks. Check vacuum and interface nut.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 22 Pace 01 Pace 02 Pace 03 Pace 07 Pace 23 Pace 24

QAPP Worksheet #25 (continued)
Analytical Instrument and Equipment Maintenance, Testing, and Inspection

INSTRUMENT/ EQUIPMENT	MAINTENANCE ACTIVITY	TESTING ACTIVITY	INSPECTION ACTIVITY	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	RESPONSIBLE PERSON	SOP REFERENCE[1]
Purge & Trap (Concentrator)	Replace trap. Leak check.	None specified	Check for 5-mL transfer. Check pressure gauges and purge flow.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 22 Pace 01
Purge & Trap (Autosampler)	Flush IS / IS/SS sipper tube. Syringe replacement (plunger assembly). Check calibrating arm. Leak check. Clean unit.	None specified	Check/clean sample cup/waste line. Replace internal and surrogate standard solutions. Check purge flow rate.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 22 Pace 01
ICP/MS	Clean cones and torch components. Replace EM. Clean spray chamber.	None specified	Fill Di rinse. Check peristaltic tubing. Fill internal standards. Empty waste. Check argon. Check chiller temperature.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 22
CVAA	Change filter on manifold. Clean entire system. Change Hg filter on back of instrument.	None specified	Check all tubing. WD the pump. Run FIAS program to leak check.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 22 Pace 09

QAPP Worksheet #25 (continued)
Analytical Instrument and Equipment Maintenance, Testing, and Inspection

INSTRUMENT/ EQUIPMENT	MAINTENANCE ACTIVITY	TESTING ACTIVITY	INSPECTION ACTIVITY	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	RESPONSIBLE PERSON	SOP REFERENCE[1]
Balance	Per maintenance schedule in the operator's manual.	Per maintenance schedule in the operator's manual.	Per maintenance schedule in the operator's manual.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 19
Ion Chromatograph	Changing the sample loop. Replace DS4 cell. Clean cell electrodes. Calibrate cell constant. Calibrate pump flow rate. Replace pump components. Replace analytical and guard columns. ASRS ULTRA II.	None specified	Check for leaks and spills within the valve compartments. Check all air and liquid lines for discoloration or crimping.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 22 Pace 16
Automated Visible Spectro-photometer	Per maintenance schedule in the operator's manual.	Per maintenance schedule in the operator's manual.	Per maintenance schedule in the operator's manual.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 12 Pace 13
Visible spectrophoto-meter	Per maintenance schedule in the operator's manual.	Per maintenance schedule in the operator's manual.	Per maintenance schedule in the operator's manual.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 10 Pace 11 Pace 14

QAPP Worksheet #25 (continued)
Analytical Instrument and Equipment Maintenance, Testing, and Inspection

INSTRUMENT/ EQUIPMENT	MAINTENANCE ACTIVITY	TESTING ACTIVITY	INSPECTION ACTIVITY	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	RESPONSIBLE PERSON	SOP REFERENCE[1]
Balance	Per maintenance schedule in the operator's manual.	Per maintenance schedule in the operator's manual.	Per maintenance schedule in the operator's manual.	See SOP Reference	See SOP Reference	Inspect system, correct problem, rerun calibration, and reanalyze affected samples, if necessary.	Analyst	Pace 19

Footnote:
(1) See Analytical SOP References (Worksheet #23).

QAPP Worksheet #26
Sample Handling System (Pace Analytical)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (personnel/organization): LSRG Site Manager (TRC)/TRC field sampling team/TRC On-site Coordinator
Sample Packaging (personnel/organization): LSRG Site Manager (TRC)/TRC field sampling team/TRC On-site Coordinator
Coordination of Shipment (personnel/organization): LSRG Site Manager (TRC)/TRC field sampling team/TRC On-site Coordinator
Type of Shipment/Carrier: Overnight courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (personnel/organization): Kate Grams, Pace Analytical (or designee)
Sample Custody and Storage (personnel/organization): Kate Grams, Pace Analytical (or designee)
Sample Preparation (personnel/organization): Kate Grams, Pace Analytical (or designee)
Sample Determinative Analysis (personnel/organization): Kate Grams, Pace Analytical (or designee)
SAMPLE ARCHIVING
Field Sample Storage (number of days from sample collection): 30 days from submittal of final report
Sample Extract/Digestate Storage (number of days from extraction/digestion): 60 days from submittal of final report
Biological Sample Storage (number of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Kate Grams, Pace Analytical (or designee)
Number of Days from Analysis: minimum of 60 days from submittal of final report

QAPP Worksheet #27
Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

- The field sampler is personally responsible for the care and custody of the samples until they are transferred to the laboratory or properly dispatched. Keep the number of people handling the samples to a minimum to ensure proper field Chain-of-Custody.
- Field Chain-of-Custody Records will accompany all analytical samples and sample shipping containers to document their transfer from the field to the analytical laboratory. The procedures to be implemented are as follows:
  - Complete Chain-of-Custody Records Indicating sample identification, containers filled, sampling date, sampling time, sample collector's name, and sample preservation, if applicable. Also note this information in the field notebooks.
  - Repack shipping containers with samples, Chain-of-Custody Records, and water ice. Assign a Chain-of-Custody Record to each set of sample containers to be shipped.
  - Place completed Chain-of-Custody Records in a plastic bag, seal the bag, and tape it to the inside cover of the shipping container. After the samples are iced, add the date to the Chain-of-Custody Record, seal the coolers with strapping tape, and ship the coolers to Pace Analytical Laboratory using an overnight delivery service. Identify common carriers or intermediate individuals on the Chain-of-Custody Record, and retain copies of all bills-of-lading. When the samples are received in the laboratory, handle and process them in accordance with laboratory SOPs, or specified analytical methods, as defined in this QAPP.
  - The laboratory receiving the samples will check shipping containers for completeness of paperwork, damaged sample containers, and sample preservation as specified by the analytical method. The laboratory's sample management staff will note any problems, log the samples into the laboratory, and complete the Chain-of-Custody Record. The person relinquishing the samples to the facility or agency will request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is to be noted in the "Received By" space on the Record.
  - Include copies of the Chain-of-Custody Record with the analytical data.
- A separate sample receipt is prepared whenever samples are split with a government agency. The receipt is marked to indicate with whom the samples are being split. The person relinquishing the samples to the agency should request the agency representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is to be noted on the receipt and in the field notebook.
- A copy of the Chain-of-Custody Record will accompany the samples to the laboratory. The field sampling personnel will retain one copy with the field notes. If a Chain-of-Custody Record Is damaged in shipment, the field copy will be made available. A written statement will be prepared by the person who collected the samples, listing the samples that were recorded on the damaged record, and describing when and how the samples were collected. The statement should include information such as field notebook entries regarding the sample. This statement is submitted to the On-site Coordinator and the TRC Project Manager for further action, as necessary.

QAPP Worksheet #27 (continued)
Sample Custody Requirements

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

The laboratory assigns a unique, sequentially numbered sample code to each sample received. Laboratory custody procedures for sample receiving and log-in, storage, tracking, and holding time requirements are described in the laboratory's Quality Assurance Manual and in the Laboratory SOPs (see Attachment 4).

Sample Identification Procedures:

- Label each bottle with the sample identifier, the sample type, the sampler's initials, and the date and time of sample collection.
- Complete sample labels for each sample and custody seals for each shipment container using waterproof ink, unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ink pen would not function in freezing weather.

Chain-of-Custody Procedures:

An example Chain-of-Custody Record from Pace Analytical Laboratory is shown in Attachment 4. The Records should be legibly completed. Errors will be corrected by drawing a single line through the incorrect information and entering the correct information. All corrections are to be initialed and dated by the person making the correction. This procedure applies to words or figures inserted or added to a previously recorded statement.

The following information must be included on the Chain-of-Custody Record:

- Facility name and address, project number, and sampler identification.
- "The Sample ID No. and Description" portion of the Record must be completed for each sample. This information includes the Field Sample ID, sample date and time, and sample depth. The sampling time MUST also be noted on the sample bottle (except for blind field duplicates, where the sample time would not be noted on the bottle label or Chain-of-Custody Record).
- The sample container type and number, sample matrix, preservative/filtration, and requested analysis must be designated by checking the appropriate box and/or writing the required information.

QAPP Worksheet #27 (continued)
Sample Custody Requirements

Chain-of-Custody Procedures (continued):

Sample custody is documented on the lower portion of the Record, and includes the sampler's signature, signatures of persons involved in the possession of the sample with dates and times, and the date on which the sample was received at the laboratory, as described further below.

- *Relinquished by/Received by* - This part of the Chain-of-Custody Record is a record of the individuals who actually had the samples in their custody. The spaces must be used in chronological order as the Chain-of-Custody Record is transferred with the samples.
  - (1) Sampler signs when relinquishing custody.
  - (1) Person accepting custody of samples from sampler signs.
  - (2) Person in (1) must sign when relinquishing custody.
  - (2)-(3) These are completed as necessary in the same manner as above.
- *Sampler* - The person/persons collecting the samples must sign their name and print their name under their signature, and record the date and time they relinquish the samples to either the laboratory or the shipper. The final signature is that of the person receiving the samples at the laboratory.
- *Special Instructions* – The sampler may provide additional information about a sample, *e.g.*, if an odor is present, high or low pH, etc.
- *Possible Hazard Identification* – The sampler may include any known or suspected hazards associated with the samples. Sample entry personnel may add information to this section based on communications from the laboratory Project Manager or Supervisor after samples are received. Laboratory Team Leaders will use any hazard information to update and advise their analysts before work is started.

Note: If commercial carriers are used, the name of the carrier, any airbill number, and the date and time of relinquishing the sample containers are written on the airbill by sample entry or field personnel, and the airbill is attached to the Chain-of-Custody Record.

A copy of the Chain-of-Custody Record should be returned with the sample results. The laboratory service request number should be written on the Chain-of-Custody Record to facilitate its use during project data entry.

QAPP Worksheet #28-1
QC Samples – VOCs (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC
Analytical Group: VOCs | Analytical Method/SOP Reference: Pace 01 | Analytical Organization: Pace
Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Surrogates	3 per sample	Laboratory control limits	Re-analysis	Laboratory staff	Accuracy	% Recovery
Internal standards	4 per sample	Peak area within -50% to +100%, and retention times within ± 30 seconds of ICAL midpoint ISs	Re-analysis	Laboratory staff	Instrument performance, quantitation	Peak areas and retention times
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-analysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-analysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-2
QC Samples – Dissolved Gases (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC
Analytical Group: Dissolved gases | Analytical Method/SOP Reference: Pace 06 | Analytical Organization: Pace
Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicates	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-analysis	Laboratory staff	Bias/Contamination	% Recovery
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-analysis	Laboratory staff	Accuracy	< Laboratory reporting limit
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-3
QC Samples – Semi-volatile Organic Compounds (Water)

Matrix: Water
Sampling SOP: F-1
Field Sampling Organization: TRC
Analytical Group: SVOCs PAHs by SIM
Analytical Method/SOP Reference: Pace 02 Pace 03
Analytical Organization: Pace
Concentration Level: All
Sampler's Name: NA
Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Surrogates	2 per sample	Laboratory control limits	Re-extraction /re-analysis	Laboratory staff	Accuracy	% Recovery
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-extraction /re-analysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-extraction/re-analysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-4
QC Samples - PCBs (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC
Analytical Group: PCBs | Analytical Method/SOP Reference: Pace 04 | Analytical Organization: Pace
Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Surrogates	2 per sample	Laboratory control limits	Re-extraction /re-analysis	Laboratory staff	Accuracy	% Recovery
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-extraction /re-analysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-extraction/re-analysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-5
QC Samples – Organochlorine Pesticides (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC

Analytical Group: Organochlorine Pesticides | Analytical Method/SOP Reference: Pace 05 | Analytical Organization: Pace

Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Surrogates	2 per sample	Laboratory control limits	Re-extraction /re-analysis	Laboratory staff	Accuracy	% Recovery
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-extraction /re-analysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	<Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-extraction/re-analysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-6
QC Samples – Organophosphate Pesticides (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC

Analytical Group: Organophosphate Pesticides | Analytical Method/SOP Reference: Pace 21 | Analytical Organization: NLS (Subcontract)

Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Surrogates	2 per sample	Laboratory control limits	Re-extraction /re-analysis	Laboratory staff	Accuracy	% Recovery
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-extraction /re-analysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	<Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-extraction/re-analysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-7
QC Samples – Dioxins and Furans (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC
Analytical Group: Dioxins and Furans | Analytical Method/SOP Reference: Pace 07 | Analytical Organization: Pace
Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Internal standards (labeled surrogates)	2 per sample	Laboratory control limits	Re-extraction /re-analysis	Laboratory staff	Accuracy	% Recovery
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-extraction /re-analysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-extraction/re-analysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-8
QC Samples – Metals, Target Analyte List (except Hg) (Water)

Matrix: Water
Sampling SOP: F-1
Field Sampling Organization: TRC
Analytical Group: Metals, (except Hg)
Analytical Method/SOP Reference: Pace 08
Analytical Organization: Pace
Concentration Level: All
Sampler's Name: NA
Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicates	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-analysis	Laboratory staff	Bias/Contamination	% Recovery
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-analysis	Laboratory staff	Accuracy	< Laboratory reporting limit
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-9
QC Samples – Mercury (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC
Analytical Group: Mercury | Analytical Method/SOP Reference: TA-13 | Analytical Organization: Pace
Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicates	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-analysis	Laboratory staff	Bias/Contamination	% Recovery
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-analysis	Laboratory staff	Accuracy	< Laboratory reporting limit
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-10
QC Samples – Wet Chemistry (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC

Analytical Group: Wet Chemistry | Analytical Method/SOP Reference: Pace 10-12, 14-16, 18 | Analytical Organization: Pace

Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicates	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-analysis	Laboratory staff	Bias/Contamination	% Recovery
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-analysis	Laboratory staff	Accuracy	< Laboratory reporting limit
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-11
QC Samples – Amenable Cyanide (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC
Analytical Group: Amenable Cyanide | Analytical Method/SOP Reference: Pace 20 | Analytical Organization: Badger Lab (subcontract)
Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-extraction /re-analysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	<Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-extraction/re-analysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-12
QC Samples – Semi-volatile Organic Compounds (Water)

Matrix: Water
Sampling SOP: F-1
Field Sampling Organization: TRC
Analytical Group: SVOC 1,4-Dioxane by EPA 522 Modified
Analytical Method/ SOP Reference: Pace 23
Analytical Organization: TestAmerica-VT (Subcontract)
Concentration Level: All
Sampler's Name: NA
Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Surrogates	1 per sample	Laboratory control limits	Re-extraction /re-analysis	Laboratory staff	Accuracy	% Recovery
Internal standards	3 per sample	Peak area within ±30% of CCV and retention times within ±30 seconds of midpoint of ICAL	Re-analysis	Laboratory staff	Instrument Performance, Quantitation	Peak areas and retention times
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-extraction /re-analysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-extraction/re-analysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #28-13
QC Samples – Vinyl Chloride (Water)

Matrix: Water | Sampling SOP: F-1 | Field Sampling Organization: TRC
Analytical Group: VOCs | Analytical Method/SOP Reference: Pace 24 | Analytical Organization: CT Labs (Subcontract)
Concentration Level: All | Sampler's Name: NA | Number of Sample Locations: To be determined

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD < 35%	Qualify data as needed	TRC data validation staff	Precision	RPD
Surrogates	4 per sample	Laboratory control limits	Re-analysis	Laboratory staff	Accuracy	% Recovery
Internal standards	4 per sample	Peak area within -50% to +100%, and retention times within ± 30 seconds of ICAL midpoint ISs	Re-analysis	Laboratory staff	Instrument performance, quantitation	Peak areas and retention times
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-analysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed	TRC data validation staff	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-analysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed	Laboratory staff and TRC data validation staff	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #29
Project Documents and Records

SAMPLE COLLECTION DOCUMENTS AND RECORDS	ON-SITE ANALYSIS DOCUMENTS AND RECORDS	OFF-SITE ANALYSIS DOCUMENTS AND RECORDS	DATA ASSESSMENT DOCUMENTS AND RECORDS	OTHER
▪ Field notes ▪ Sampling logs ▪ Chain-of-Custody Records ▪ Air bills ▪ Custody seals	▪ Equipment calibration logs ▪ Field data records ▪ Field instrument maintenance logs	▪ Sample receipt, custody, and tracking records ▪ Standard traceability logs ▪ Equipment calibration logs ▪ Sample prep logs ▪ Run logs ▪ Equipment maintenance, testing, and inspection logs ▪ Corrective action forms ▪ Reported field sample results ▪ Reported results for standards, QC checks, and QC samples ▪ Instrument printouts (raw data) for field sample standards, QC checks, and QC sample ▪ Data package completeness checklists ▪ Sample disposal records ▪ Extraction/Cleanup records ▪ Raw data (stored on diskette or CD-R) ▪ Analytical reports	▪ Data validation checklists ▪ Data quality assessments	▪ Consent Decree documents ▪ Progress reports to the U.S. EPA ▪ Work plans and Sampling and Analysis Plans ▪ Health and Safety Plans ▪ Quality Assurance Project Plan ▪ Quality Management Plan ▪ Remedial Investigation and Risk Assessment Reports ▪ Feasibility Studies ▪ Design Reports ▪ Construction Documentation Reports ▪ Monitoring Reports ▪ Communication logs

QAPP Worksheet #30
Analytical Services

MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	SAMPLE LOCATIONS/ ID NUMBERS	ANALYTICAL SOP	DATA PACKAGE TURNAROUND TIME	LABORATORY/ ORGANIZATION (name, address, contact person, and telephone number)	BACKUP LABORATORY/ ORGANIZATION (name, address, contact person, and telephone number)
Water	VOCs Dissolved gases SVOCs PCBs Pesticides Dioxins/Furans Metals, BOD, TSS, Wet chemistry	All	TBD	Pace 01 through Pace 24	Standard turnaround time (14 business days for Level II reports; 28 business days for Level IV reports)	Pace Analytical Services, Inc., Wisconsin 1241 Bellevue St. #9 Green Bay, WI 54302 Brian Basten (920) 321-9411 or Kate Grams (Quality Manager) (920) 469-2436	Test America – Chicago 2417 Bond Street University Park, IL 60466 Bonnie Stadelmann (Project Manager) or Terese Preston (Quality Manager) (708) 534-5200
Data Validation	All	All	--	All	--	Gretchen Rahn TRC 708 Heartland Trail Madison, WI 53717	--

Notes:
NA = not applicable.
TBD = to be determined.

QAPP Worksheet #31-1
Planned Project Assessments
(Long Term Monitoring)

ASSESSMENT TYPE	FREQUENCY	INTERNAL OR EXTERNAL	ORGANIZATION PERFORMING ASSESSMENT	PERSON(S) RESPONSIBLE FOR PERFORMING ASSESSMENT (title and organizational affiliation)	PERSON(S) RESPONSIBLE FOR RESPONDING TO ASSESSMENT FINDINGS (title and organizational affiliation)	PERSON(S) RESPONSIBLE FOR IDENTIFYING AND IMPLEMENTING CORRECTIVE ACTIONS (CA) (title and organizational affiliation)	PERSON(S) RESPONSIBLE FOR MONITORING EFFECTIVENESS OF CA (title and organizational affiliation)
Field performance audit	Periodic, based on field schedule	Internal	TRC	Kristopher Krause, TRC (Project Manager)	Kristopher Krause, TRC (Project Manager)	TRC On-site Sampling Coordinator	Kristopher Krause, TRC (Project Manager)
Field systems audit	Periodic, based on field schedule	Internal	TRC	Tom Stolzenburg, TRC (Data QA Manager)	Kristopher Krause, TRC (Project Manager)	TRC Field Sampling Coordinator	Kristopher Krause, TRC (Project Manager)
Laboratory audit	As needed, based on laboratory performance	External	TRC	Tom Stolzenburg, TRC (Data QA Manager)	Kate Grams, Pace Analytical (Laboratory QA Manager)	Kate Grams, Pace Analytical (Laboratory QA Manager)	Tom Stolzenburg, TRC (Data QA Manager)
Laboratory audit	Per laboratory QA Plan	Internal	Pace	Kate Grams, Pace Analytical (Laboratory QA Manager)	Kate Grams, Pace Analytical (Laboratory QA Manager)	Kate Grams, Pace Analytical (Laboratory QA Manager)	Tom Stolzenburg, TRC (Data QA Manager)

QAPP Worksheet #31-2
Planned Project Assessments
(Groundwater Monitoring Well Installation)

ASSESSMENT TYPE	FREQUENCY	INTERNAL OR EXTERNAL	ORGANIZATION PERFORMING ASSESSMENT	PERSON(S) RESPONSIBLE FOR PERFORMING ASSESSMENT (title and organizational affiliation)	PERSON(S) RESPONSIBLE FOR RESPONDING TO ASSESSMENT FINDINGS (title and organizational affiliation)	PERSON(S) RESPONSIBLE FOR IDENTIFYING AND IMPLEMENTING CORRECTIVE ACTIONS (CA) (title and organizational affiliation)	PERSON(S) RESPONSIBLE FOR MONITORING EFFECTIVENESS OF CA (title and organizational affiliation)
Field performance audit	Periodic, based on field schedule	Internal	TRC	Kristopher Krause, TRC (Project Manager)	Kristopher Krause, TRC (Project Manager)	TRC Field Sampling Coordinator	Kristopher Krause, TRC (Project Manager)
Field systems audit	Periodic, based on field schedule	Internal	TRC	Tom Stolzenburg, TRC (Data QA Manager)	Kristopher Krause, TRC (Project Manager)	TRC Field Sampling Coordinator	Kristopher Krause, TRC (Project Manager)
Laboratory audit	As needed, based on laboratory performance	External	TRC	Tom Stolzenburg, TRC (Data QA Manager)	Kate Grams, Pace Analytical (Laboratory QA Manager)	Kate Grams, Pace Analytical (Laboratory QA Manager)	Tom Stolzenburg, TRC (Data QA Manager)
Laboratory audit	Per laboratory QA Plan	Internal	Pace	Kate Grams, Pace Analytical (Laboratory QA Manager)	Kate Grams, Pace Analytical (Laboratory QA Manager)	Kate Grams, Pace Analytical (Laboratory QA Manager)	Tom Stolzenburg, TRC (Data QA Manager)

QAPP Worksheet #32-1
Assessment Findings and Corrective Action Responses
(Long Term Monitoring)

ASSESSMENT TYPE	NATURE OF DEFICIENCIES DOCUMENTATION	INDIVIDUAL(S) NOTIFIED OF FINDINGS (name, title, organization)	TIME FRAME OF NOTIFICATION	NATURE OF CORRECTIVE ACTION RESPONSE DOCUMENTATION	INDIVIDUAL(S) RECEIVING CORRECTIVE ACTION RESPONSE (name, title, organization)	TIME FRAME FOR RESPONSE
Field performance audit	Checklist	Kristopher Krause, TRC (Project Manager)	Within 72 hours after audit (or sooner, as appropriate)	E-mail response	TRC Field Sampling Coordinator	Within 48 hours after notification (or sooner, as appropriate)
Field systems audit	Checklist	Tom Stolzenburg, TRC (Data QA Manager), will notify Kristopher Krause, TRC (Project Manager)	Within 48 hours after audit (or sooner, as appropriate)	E-mail response	TRC Field Sampling Coordinator	Within 48 hours after notification (or sooner, as appropriate)
Internal laboratory audit	Executive Summary from Management Report	Kate Grams, Pace Analytical (Laboratory QA Manager), will notify Tom Stolzenburg, TRC (Data QA Manager), and appropriate laboratory staff.	Within 48 hours after audit (or sooner, as appropriate)	Executive Summary from Management Report	Gretchen Rahn (TRC, Inc.), and appropriate staff	Within 48 hours after notification (or sooner, as appropriate)
External laboratory audit	Checklist	Tom Stolzenburg, TRC (Data QA Manager), will notify Kate Grams, Pace Analytical (Laboratory QA Manager), and Kristopher Krause, TRC (Project Manager)	Within 1 week after audit	Memorandum	Kate Grams, Pace Analytical (Laboratory QA Manager)	Within 48 hours after notification (or sooner, as appropriate)

QAPP Worksheet #32-2
Assessment Findings and Corrective Action Responses
(Groundwater Monitoring Well Installation)

ASSESSMENT TYPE	NATURE OF DEFICIENCIES DOCUMENTATION	INDIVIDUAL(S) NOTIFIED OF FINDINGS (name, title, organization)	TIME FRAME OF NOTIFICATION	NATURE OF CORRECTIVE ACTION RESPONSE DOCUMENTATION	INDIVIDUAL(S) RECEIVING CORRECTIVE ACTION RESPONSE (name, title, organization)	TIME FRAME FOR RESPONSE
Field performance audit	Checklist	Kristopher Krause, TRC (Project Manager)	Within 72 hours after audit (or sooner, as appropriate)	E-mail response	TRC Field Sampling Coordinator	Within 48 hours after notification (or sooner, as appropriate)
Field systems audit	Checklist*	Tom Stolzenburg, TRC (Data QA Manager), will notify Kristopher Krause, TRC (Project Manager)	Within 48 hours after audit (or sooner, as appropriate)	E-mail response	TRC Field Sampling Coordinator	Within 48 hours after notification (or sooner, as appropriate)
Internal laboratory audit	Executive Summary from Management Report	Kate Grams, Pace Analytical (Laboratory QA Manager), will notify Tom Stolzenburg, TRC (Data QA Manager), and appropriate laboratory staff.	Within 48 hours after audit (or sooner, as appropriate)	Executive Summary from Management Report	Gretchen Rahn (TRC) and appropriate staff	Within 48 hours after notification (or sooner, as appropriate)
External laboratory audit	Checklist	Kristopher Krause, TRC (Project Manager)	Within 1 week after audit	Memorandum	Kate Grams, Pace Analytical (Laboratory QA Manager)	Within 48 hours after notification (or sooner, as appropriate)

QAPP Worksheet #33
QA Management Reports

TYPE OF REPORT	FREQUENCY (daily, weekly, monthly, quarterly, annually, etc.)	PROJECTED DELIVERY DATE(S)	PERSON(S) RESPONSIBLE FOR REPORT PREPARATION (title and organizational affiliation)	REPORT RECIPIENT(S) (title and organizational affiliation)
Field audit reports	As needed	As generated	Kristopher Krause, TRC (Project Manager) and Tom Stolzenburg (Data QA Manager)	Kristopher Krause, TRC (Project Manager)
Pace Analytical audit (external)	As needed	As generated	Tom Stolzenburg (Data QA Manager)	Kristopher Krause, TRC (Project Manager)
Data validation reports	As specified in data assessment section	As generated	Gretchen Rahn (data validator)	Kristopher Krause, TRC (Project Manager)
Data quality summary	As appropriate for data use	As generated	Gretchen Rahn (data validator)	Kristopher Krause, TRC (Project Manager)
Data Transmittals	Quarterly	75 days following receipt of final data package	Kristopher Krause, TRC (Project Manager)	USEPA, WDNR, LSRG
O&M Progress Reports	Annually	End of December	Kristopher Krause, TRC (Project Manager)	USEPA, WDNR, LSRG
Corrective Action Reports	As needed	Within 60 days of identification of data problem	Kristopher Krause, TRC (Project Manager)	USEPA, WDNR, LSRG

QAPP Worksheet #34
Verification (Step I) Process

VERIFICATION INPUT	DESCRIPTION	INTERNAL/ EXTERNAL	RESPONSIBLE FOR VERIFICATION (name, organization)
Chain-of-Custody Records and shipping documentation	Chain-of-Custody Records and shipping documentation will be reviewed by the laboratory upon receipt of samples for verification against the sample coolers they represent. The Chain-of-Custody Record will be signed by all parties who had custody of samples, with the exception of commercial carriers.	External	Kate Grams, Pace Analytical (or designee)
Field notes and sampling logs	All field notes and sampling logs will be reviewed internally and placed in the project file.	Internal	TRC On-site Coordinator
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	External	Kate Grams, Pace Analytical
Laboratory data	All final data packages will be verified for content upon receipt.	External	Gretchen Rahn (data validator)

QAPP Worksheet #35
Validation (Step I) Process

STEP IIa/IIb	VALIDATION INPUT	DESCRIPTION	RESPONSIBLE FOR VERIFICATION (Name, Organization)
Step IIa	Sampling methods and procedures	Verify that the required analytical methods were used and that any deviations were noted.	Gretchen Rahn, TRC
Step IIa	Analytical methods	Verify that the required sampling methods were used and that any deviations were noted. The laboratory will verify that QC samples met the performance criteria, and that any deviations were noted on the sample narrative.	Kate Grams, Pace Analytical Gretchen Rahn, TRC
Step IIb	Documentation of QAPP QC sample results	Establish that all QC samples required by the QAPP were collected and analyzed.	Gretchen Rahn, TRC
Step IIb	Project Quantitation Limits	Determine that the QAPP-required Quantitation Limits were achieved.	Gretchen Rahn, TRC
Step IIb	Validation report	Summarize data findings of verification and validation components included in the QAPP. Include comments on any qualified data, and define all qualifiers.	Gretchen Rahn, TRC

QAPP Worksheet #36
Validation (Steps IIa and IIb) Summary

STEPS IIa AND IIb	MATRIX	ANALYTICAL GROUP	DATA PURPOSE	CONCENTRATION LEVEL	VALIDATION CRITERIA	DATA VALIDATOR (title and organizational affiliation)
IIa and IIb	Aqueous	PCBs, VOCs, SVOCs, pesticides, dissolved gases, dioxins/furans	Long Term Monitoring, Groundwater Monitoring Well Installation	Low, medium, high	U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (June 2008); U.S. EPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review (September 2005); method criteria, QAPP criteria; and professional judgment	Gretchen Rahn (TRC)
IIa and IIb	Aqueous	Metals	Long Term Monitoring, Groundwater Monitoring Well Installation	Low, medium, high	U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004), method criteria, QAPP criteria; and professional judgment	Gretchen Rahn (TRC)
IIa and IIb	Aqueous	General chemistry parameters	Long Term Monitoring, Groundwater Monitoring Well Installation	Low, medium, high	U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (June 2008), method criteria, QAPP criteria; and professional judgment	Gretchen Rahn (TRC)

QAPP Worksheet #37
Usability Assessment

Identify the personnel responsible for performing the usability assessment:

Kristopher Krause, TRC Project Manager; James Wedekind, TRC Hydrogeologist & QA Manager; Gretchen Rahn (TRC Data Validator); Tom Stolzenburg, TRC Data QA Manager; TRC Data Validation Staff (to be assigned) and other scientists using the data.

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

All data that passes the verification and validation process must be included in the reports, but under certain conditions, data can be excluded from interpretation of trends and contours. In general, simple evaluation procedures, which apply when the true value is known or when there are many samples of the same groundwater, cannot be applied. However, using professional judgment and comparison to other data (comparability), it is possible to conclude that certain data, even when all documentation indicates that it should be valid, could not be representative, and therefore, should be excluded from interpretation of contours and trends. Examples are listed below:

- Water levels, which for no known reason, are grossly inconsistent with contours from the nearest observation points, and results in a pattern of groundwater flow that is inconsistent with historical data or hydrogeological principles, and is not confirmed by subsequent monitoring events.
- Detections that greatly differ from historical detections for no known reason, and that are not confirmed by subsequent analyses, or when data quality correlates to quality of another well.

In such situations, the first action should be to double check documentation, and to question samplers and analysts involved. If the documentation and questioning uncovers no reason to reject the data, but the scientists and engineers determine that it must be unrepresentative, these data can be left out of contour maps or trend charts as long as there is an explanation of why these data are not being utilized. USEPA and WDNR concurrence is required for this determination.

QAPP Worksheet #37 (continued)
Usability Assessment

Describe the evaluative procedures used to assess overall measurement error associated with the project:

The data quality indicator (DQIs) used to evaluate conformance with the project DQOs are presented below.

DQIs are generally defined in terms of the following six parameters;

1. Representativeness
2. Comparability
3. Completeness
4. Precision
5. Accuracy
6. Sensitivity

Each parameter is defined below. Specific objectives for the site actions are presented in other sections of this QAPP, as referenced below.

Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions, and is dependent on sampling and analytical variability and the variability of environmental media at the site. Actions have been designed to assess the presence of chemical constituents at the time of sampling. The QAPP presents the rationale for sample quantities and location. This QAPP presents field sampling and laboratory analytical methodologies. Use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements is intended to provide representative data.

Comparability

Comparability is the degree of confidence with which one data set can be compared with another. Comparability between phases of the actions (if additional phases are required) will be maintained through consistent use of the sampling and analytical methodologies set forth in the QAPP, the established QA/QC procedures, and the use of appropriately trained personnel.

Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event and/or investigation compared to the total amount that was obtained. This will be determined upon final assessment of the analytical results. Completeness of a field or laboratory data set will be calculated by comparing the number of valid sample results generated with the total number of results generated.

$$\text{Completeness} = \frac{\text{Number valid results}}{\text{Total number of results generated}} \times 100$$

As a general guideline, overall project completeness is expected to be at least 90 percent. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

QAPP Worksheet #37 (continued)
Usability Assessment

Precision

Precision is a measure of the reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the objectives of the action. To maximize precision, sampling and analytical procedures will be followed. All work for the site actions will adhere to the established protocols presented in the QAPP. Checks for analytical precision will include the analysis of MS/MSDs, laboratory duplicates, and field duplicates. Checks for field measurement precision will include duplicate field measurements.

The precision of data will be measured by calculating the Relative Percent Difference (RPD) by the following equation:

$$RPD = \frac{(A-B)}{(A+B)/2} \times 100,$$

where

A = analytical result from one of two duplicate measurements,
B = analytical result from the second measurement.

Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, reference standards, MSs, blank spikes, and surrogate standards will be used to assess the accuracy of the analytical data.

Accuracy will be calculated in terms of percent recovery as follows:

$$\% \text{ Recovery} = \frac{A-X}{B} \times 100,$$

where

A = value measured in spiked sample or standard,
X = value measured in original sample,
B = true value of amount added to sample or true value of standard.

Sensitivity

Sensitivity is a quantitative measurement to determine if the analytical laboratory's procedures/methodologies and their associated MDLs can satisfy the project requirements as they relate to the project action limits. MDLs are updated annually by the laboratory.

QAPP Worksheet #37 (continued)
Usability Assessment

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The data validation report will address the following items:

- Overall quality and usability of the data
- Evaluation of QC data, including precision, accuracy, and completeness of the data
- Potential sample contamination due to blank contributions
- Assessment of laboratory and field records
- Actions regarding specific QC criteria exceedences

Laboratory-applied data qualifiers will be defined within the analytical data package received from the laboratory. The sample narrative will also detail quality control issues identified by the laboratory.

Data validation qualifiers that may be applied to the data include the following:

- u The analyte/compound was analyzed for, but not detected. The associated value is the compound's Limit of Quantitation.
- j The compound was positively identified; however, the associated numerical value is an estimated concentration only.
- h The samples are past the allowable hold time. Sample results are estimated.
- r The sample results are rejected.

A data quality assessment (DQA) will be conducted after the data are validated. The steps in the DQA are as follows:

- Review project objectives and sampling design.
- Conduct preliminary data review.
- Select statistical method (if appropriate).
- Verify assumptions of the method (if appropriate).
- Draw conclusions from the data.

Attachment 1
Long Term Monitoring Program

Table A-1
Long Term Monitoring - Analytical Program Summary
Lemberger Landfill and Lemberger Transport and Recycling Site
Town of Franklin, Wisconsin

PROGRAM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Groundwater Performance Monitoring												
LTR Sentinel Wells			X			X			X			X
LTR Plume Wells (S)			X						X			
LTR Plume Wells (A)									X			
LL Wells									X			
Residential Wells (S)			X						X			
Residential Wells (A)									X			
Treated Effluent Monitoring												
System Operation Test	X			X			X			X		
Leachate Monitoring	(To Be Determined)[1]											
Leachate Head Wells	(To Be Determined)[2]											
Gas Migration Monitoring (LTR)											X	

Footnotes:

(1) Leachate sampling schedule determined based on system operation.

21) Leachate head wells will be sampled periodically at the request of WDNR and USEPA. The analytical program will be determined per sampling event.

Table A-2
Groundwater Monitoring - Quarterly Analytical Program (June, December)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

WELL GROUP	PARAMETER GROUP	PARAMETER OR PARAMETER LIST	METHOD	LABORATORY REPORTING LEVEL[2]
LTR Sentinel Wells:	VOCs	TAL	8260B/8260C	Level IV
RM-2I, RM-2D, RM-3XD, RM-203D, RM-210D, RM-211D, RM-212D, RM-401XD, RM-401XXD	Field Parameters	Field Parameters[1]	Field	

Footnotes:

[1] Field parameters include: Water elevation (where applicable), specific conductance, dissolved oxygen, redox potential, pH, temperature, turbidity, and a description of the color and odor of the sample.

[2] Laboratory reporting levels are defined in QAPP Worksheet #15.

Table A-3
Groundwater Monitoring - Semiannual Analytical Program (March)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

WELL GROUP	PARAMETER GROUP	PARAMETER OR PARAMETER LIST	METHOD	LABORATORY REPORTING LEVEL[3]
LTR Sentinel Wells: RM-2I, RM-2D, RM-3XD, RM-203D, RM-210D, RM-211D, RM-212D, RM-401XD, RM-401XXD	VOCs	TAL	8260B/8260C	Level IV
	Field Parameters	Field Parameters[1]	Field	
LTR Plume Wells Group S: RM-3D, RM-5D, RM-7XD, RM-7XXD, RM-8D, RM-101D, RM-203D, RM-204D, RM-208D, RM-208XD, RM-209D, RM-303D, RM-306D, RM-307D, RM-401D	VOCs	TAL	8260B	Level III
	Dissolved Gases	Methane	8015B	
	Field Parameters	Field Parameters[1]	Field	
Residential Wells Group S: GR-8, GR-9, GR-10, GR-11, GR-12, GR-13, GR-14, GR-15, GR-17, GR-25, GR-26, GR-27, GR-62, GR-63, GR-64, GR-66	VOCs	TAL	8260B/8260C	Level IV
	SVOCs[2]	PAH (TAL)	8270C-SIM	
		Bis(2-ethylhexyl)phthalate	8270C	
		Pentachlorophenol	8270C	
		1,4-dioxane	EPA 522 Mod.	
	PCBs[2]	TAL	8082A	
	Field Parameters	Field Parameters[1]	Field	

Footnotes:

[1] Field parameters include: Water elevation (where applicable), specific conductance, dissolved oxygen, redox potential, pH, temperature, turbidity, and a description of the color and odor of the sample.

[2] Parameter/parameter group may be removed from the sampling program after 2 consecutive annual monitoring events, pending evaluation.

[3] Laboratory reporting levels are defined in QAPP Worksheet #15.

Table A-4
Groundwater Monitoring - Annual Analytical Program (September)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

WELL GROUP	PARAMETER GROUP	PARAMETER OR PARAMETER LIST	METHOD	LABORATORY REPORTING LEVEL[3]
LTR Sentinel Wells: RM-2I, RM-2D, RM-3XD, RM-203D, RM-210D, RM-211D, RM-212D, RM-401XD, RM-401XXD	VOCs	TAL	8260B/8260C	Level IV
	SVOCs	TAL	8270C/8270C-SIM (PAHs)	
	SVOCs[2]	1,4-dioxane	EPA 522 Mod.	
	PCBs[2]	TAL	8082A	
	Metals	TAL, dissolved	6020A/7470A	
	Inorganic Indicators	Alkalinity as $CaCo_3$, total	SM 2320B	
		Chloride, total	EPA 300.0	
		Cyanide, total	EPA 335.4	
		Nitrogen, nitrate + nitrite	EPA 353.2	
		Sulfate, total	EPA 300.0	
	Field Parameters	Field Parameters[1]	Field	
LTR Plume Wells Group S: RM-3D, RM-5D, RM-7XD, RM-7XXD, RM-8D, RM-101D, RM-203D, RM-204D, RM-208D, RM-208XD, RM-209D, RM-303D, RM-306D, RM-307D, RM-401D	VOCs	TAL	8260B	Level III
	Dissolved Gases	Methane	8015B	
	SVOCs	TAL	8270C/8270C-SIM (PAHs)	
	SVOCs[2]	1,4-dioxane	EPA 522 Mod.	
	Pesticides	TAL	8081A	
	PCBs[2]	TAL	8082A	
	Metals	TAL, dissolved	6020A/7470A	
	Inorganic Indicators	Alkalinity as $CaCo_3$, total	SM 2320B	
		Chloride, total	EPA 300.0	
		Nitrogen, nitrate + nitrite	EPA 353.2	
		Sulfate, total	EPA 300.0	
	Field Parameters	Field Parameters[1]	Field	

Table A-4 (continued)
Groundwater Monitoring - Annual Analytical Program (September)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

WELL GROUP	PARAMETER GROUP	PARAMETER OR PARAMETER LIST	METHOD	LABORATORY REPORTING LEVEL[3]
LTR Plume Wells Group A: RM-1D, RM-3I, RM-4D, RM-5I, RM-7S, RM-7D, RM-10D, RM-101I, RM-103D, RM-102D, RM-202D, RM-203I, RM-204I, RM-208I, RM-210I, RM-212I, RM-213D, RM-214D, RM-304D, RM-305D, RM-308D, EW-01D, EW-03D, EW-04D, EW-6D, EW-07D	VOCs	TAL	8260B	Level III
	Dissolved Gases	Methane	8015B	
	SVOCs[2]	PAH (TAL)	8270C-SIM	
		Bis(2-ethylhexyl)phthalate	8270C	
		Pentachlorophenol	8270C	
		1,4-dioxane	EPA 522 Mod.	
	PCBs[2]	TAL	8082A	
	Metals	Iron, dissolved	6020A	
		Manganese, dissolved	6020A	
	Inorganic Indicators	Alkalinity as $CaCo_3$, total	SM 2320B	
		Chloride, total	EPA 300.0	
		Nitrogen, nitrate + nitrite	EPA 353.2	
		Sulfate, total	EPA 300.0	
	Field Parameters	Field Parameters[1]	Field	
LL Wells: RM-5S, RM-206S, RM-207S, RM-208S, RM-301S, RM-302S	VOCs	TAL	8260B	Level III
	SVOCs[2]	1,4-dioxane	EPA 522 Mod.	
	Field Parameters	Field Parameters[1]	Field	
Residential Wells Group S: GR-8, GR-9, GR-10, GR-11, GR-12, GR-13, GR-14, GR-15, GR-17, GR-25, GR-26, GR-27, GR-62, GR-63, GR-64, GR-66	VOCs	TAL	8260B/8260C	Level IV
	SVOCs[2]	PAH (TAL)	8270C-SIM	
		Bis(2-ethylhexyl)phthalate	8270C	
		Pentachlorophenol	8270C	
		1,4-dioxane	EPA 522 Mod.	
	PCBs[2]	TAL	8082A	
	Field Parameters	Field Parameters(1)	Field	
Residential Wells Group A: GR-16, GR-24, GR-30, GR-60R, GR-65, GR-67, GR-68, GR-69, GR-70, GR-71, GR-72	VOCs	TAL	8260B/8260C	Level IV
	SVOCs[2]	PAH (TAL)	8270C-SIM	
		Bis(2-ethylhexyl)phthalate	8270C	
		Pentachlorophenol	8270C	
		1,4-dioxane	EPA 522 Mod.	
	PCBs[2]	TAL	8082A	
	Field Parameters	Field Parameters[1]	Field	

Footnotes:

(1) Field parameters include: Water elevation (where applicable), specific conductance, dissolved oxygen, redox potential, pH, temperature, turbidity, and a description of the color and odor of the sample.

(2) Parameter/parameter group may be removed from the sampling program after 2 consecutive annual monitoring events, pending evaluation.

(3) Laboratory reporting levels are defined in QAPP Worksheet #15.

Table A-5
Effluent Sampling - Quarterly Program (January, April, October)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL[1]
Field Parameters	Color, field	Field	NA
	Conductance, specific	Field	
	Flow rate	Field	
	pH, field	Field	
	Temperature	Field	
Inorganic Indicators	Cyanide, total	EPA 335.4	Level IV
	Solids, total suspended	2540D	
Metals (TAL Subset, Total)	Aluminum, total	6020A	Level IV
	Arsenic, total	6020A	
	Beryllium, total	6020A	
	Cadmium, total	6020A	
	Chromium, total	6020A	
	Copper, total	6020A	
	Iron, total	6020A	
	Lead, total	6020A	
	Mercury, total	7470A	
	Nickel, total	6020A	
	Selenium, total	6020A	
	Silver, total	6020A	
	Zinc, total	6020A	
VOCs (TAL Subset)	1,1,1-Trichloroethane	8260B	Level IV
	1,1-Dichloroethane	8260B	
	1,1-Dichloroethene	8260B	
	1,2-Dichloroethane	8260B	
	Benzene	8260B	
	Bromodichloromethane	8260B	
	Bromoform	8260B	
	Bromomethane	8260B	
	Carbon tetrachloride	8260B	
	Chloroethane	8260B	
	Chloroform	8260B	
	Chloromethane	8260B	
	cis-1,2-Dichloroethene	8260B	
	Ethylbenzene	8260B	
	Methylene chloride	8260B	
	Tetrachloroethene	8260B	
	Toluene	8260B	
	trans-1,2-Dichloroethene	8260B	
	Trichloroethene	8260B	
	Vinyl chloride	8260B	
VOCs (Additional Parameters)	Dichlorodifluoromethane	8260B	Level IV
	Fluorotrichloromethane	8260B	

Footnotes:

[1] Laboratory reporting levels are defined in QAPP Worksheet #15.

Table A-6
Effluent Sampling - Annual Program (July)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL[1]
Field Parameters	Color, field	Field	NA
	Conductance, specific	Field	
	Flow rate	Field	
	pH, field	Field	
	Temperature	Field	
Inorganic Indicators	BOD	5210B	Level IV
	Chloride	EPA 300.0	
	Chromium, hexavalent	7196A	
	Cyanide, amenable	EPA 335.4	
	Cyanide, total	EPA 335.4	
	Hardness as $CaCo_3$, total	6020A	
	Nitrogen, ammonia	EPA 350.1	
	Phosphorus, total	EPA 365.4	
	Solids, total suspended	2540D	
Metals (TAL Subset, Total)	Aluminum, total	6020A	Level IV
	Antimony, total	6020A	
	Arsenic, total	6020A	
	Beryllium, total	6020A	
	Cadmium, total	6020A	
	Chromium, total	6020A	
	Copper, total	6020A	
	Iron, total	6020A	
	Lead, total	6020A	
	Mercury, total	7470A	
	Nickel, total	6020A	
	Selenium, total	6020A	
	Silver, total	6020A	
	Thallium, total	6020A	
	Zinc, total	6020A	
Pesticides (TAL)	4,4'-DDD	8081A	Level IV
	4,4'-DDE	8081A	
	4,4'-DDT	8081A	
	Aldrin	8081A	
	Alpha-BHC	8081A	
	Beta-BHC	8081A	
	Chlordane, technical	8081A	
	Delta-BHC	8081A	
	Dieldrin	8081A	
	Endosulfan I	8081A	
	Endosulfan II	8081A	
	Endosulfan sulfate	8081A	
	Endrin	8081A	
	Endrin aldehyde	8081A	
	Gamma-BHC (lindane)	8081A	
	Heptachlor	8081A	
	Heptachlor epoxide	8081A	
	Toxaphene	8081A	

Table A-6 (continued)
Effluent Sampling - Annual Program (July)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL
Pesticides (Additional Parameters)	Methyl parathion	8270D	Level IV
	Parathion	8270D	
PCBs (TAL)	Aroclor-1016	8082A	Level IV
	Aroclor-1221	8082A	
	Aroclor-1232	8082A	
	Aroclor-1242	8082A	
	Aroclor-1248	8082A	
	Aroclor-1254	8082A	
	Aroclor-1260	8082A	
SVOCs (TAL - Subset)	1,2,4-Trichlorobenzene	8270C	Level IV
	1,2-Dichlorobenzene	8270C	
	1,3-Dichlorobenzene	8270C	
	1,4-Dichlorobenzene	8270C	
	2,2'-Oxybis(1-chloropropane)	8270C	
	2,4,5-Trichlorophenol	8270C	
	2,4,6-Trichlorophenol	8270C	
	2,4-Dichlorophenol	8270C	
	2,4-Dimethylphenol	8270C	
	2,4-Dinitrophenol	8270C	
	2,4-Dinitrotoluene	8270C	
	2,6-Dinitrotoluene	8270C	
	2-Chloronaphthalene	8270C	
	2-Chlorophenol	8270C	
	2-Nitrophenol	8270C	
	3,3'-Dichlorobenzidine	8270C	
	4,6-Dinitro-2-methylphenol	8270C	
	4-Bromophenyl-phenylether	8270C	
	4-Chloro-3-methylphenol	8270C	
	4-Chlorophenyl-phenylether	8270C	
	4-Nitrophenol	8270C	
	Acenaphthene	8270C-SIM	
	Acenaphthylene	8270C-SIM	
	Anthracene	8270C-SIM	
	Benzo(A)anthracene	8270C-SIM	
	Benzo(A)pyrene	8270C-SIM	
	Benzo(B)fluoranthene	8270C-SIM	
	Benzo(g,h,i)perylene	8270C-SIM	
	Benzo(k)fluoranthene	8270C-SIM	
	Bis(2-chloroethoxy)methane	8270C	
	Bis(2-chloroethyl)ether	8270C	
	Bis(2-ethylhexyl)phthalate	8270C	
	Butylbenzylphthalate	8270C	
	Chrysene	8270C-SIM	
	Dibenz(a,h)anthracene	8270C-SIM	
	Diethylphthalate	8270C	
	Dimethylphthalate	8270C	
	di-n-Butylphthalate	8270C	
	di-n-Octylphthalate	8270C	

Table A-6 (continued)
Effluent Sampling - Annual Program (July)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL
SVOCs (TAL - Subset) (continued)	Fluoranthene	8270C-SIM	Level IV
	Fluorene	8270C-SIM	
	Hexachlorobenzene	8270C	
	Hexachlorobutadiene	8270C	
	Hexachlorocyclopentadiene	8270C	
	Hexachloroethane	8270C	
	Indeno(1,2,3-cd)pyrene	8270C-SIM	
	Isophorone	8270C	
	Naphthalene	8270C-SIM	
	Nitrobenzene	8270C	
	n-Nitrosodi-n-propylamine	8270C	
	n-Nitrosodiphenylamine	8270C	
	Pentachlorophenol	8270C	
	Phenanthrene	8270C-SIM	
	Phenol	8270C	
	Pyrene	8270C-SIM	
SVOCs (Additional Parameters)	1,2,4,5-Tetrachlorobenzene	8270D	Level IV
	1,2-Diphenylhydrazine	8270C	
	1,4-Dioxane[(2)]	EPA 522 Mod.	
	2,5-Dinitrophenol	8270D	
	Benzidine	8270C	
	n-Nitrosodiethylamine	8270D	
	n-Nitrosodimethylamine	8270C	
	n-Nitrosodi-N-Butylamine	8270D	
	n-Nitrosopyrrolidine	8270D	
	Pentachlorobenzene	8270D	
VOCs (TAL Subset)	1,1,1-Trichloroethane	8260B	Level IV
	1,1,2,2-Tetrachloroethane	8260B	
	1,1,2-Trichloroethane	8260B	
	1,1-Dichloroethane	8260B	
	1,1-Dichloroethene	8260B	
	1,2-Dichloroethane	8260B	
	1,2-Dichloroethene, total	8260B	
	1,2-Dichloropropane	8260B	
	Benzene	8260B	
	Bromodichloromethane	8260B	
	Bromoform	8260B	
	Bromomethane	8260B	
	Carbon tetrachloride	8260B	
	Chlorobenzene	8260B	
	Chlorodibromomethane	8260B	
	Chloroethane	8260B	
	Chloroform	8260B	
	Chloromethane	8260B	
	cis-1,2-Dichloroethene	8260B	
	cis-1,3-Dichloropropene	8260B	
	Ethylbenzene	8260B	
	Methylene chloride	8260B	
	Tetrachloroethene	8260B	

Table A-6 (continued)
Effluent Sampling - Annual Program (July)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL
VOCs (TAL Subset) (continued)	Toluene	8260B	Level IV
	trans-1,2-Dichloroethene	8260B	
	trans-1,3-Dichloropropene	8260B	
	Trichloroethene	8260B	
	Vinyl chloride	8260B	
VOCs (Additional Parameters)	1,1-Dichloropropene	8260B	Level IV
	2,3-Dichloropropene	8260B	
	2-Chloroethylvinylether	8260B	
	Acrolein	8260B	
	Acrylonitrile	8260B	
	Dichlorodifluoromethane	8260B	
	Fluorotrichloromethane	8260B	
Dioxins/Furans	2,3,7,8-TCDD	1613B	Level IV
	2,3,7,8-TCDF	1613B	

Footnotes:

(1) Laboratory reporting levels are defined in QAPP Worksheet #15.

(2) Parameter/parameter group may be removed from the sampling program after 2 consecutive annual monitoring events, pending evaluation.

Table A-7
Leachate Sampling - Quarterly Program (Schedule to be Determined)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL[1]
Field Parameters	Color, field	Field	NA
	Conductance, specific	Field	
	pH, field	Field	
	Temperature	Field	
Inorganic Indicators	BOD	5210B	Level IV
	Chloride	EPA 300.0	
	Cyanide, total	EPA 335.4	
	Phosphorus, total	EPA 365.4	
	Solids, total suspended	2540D	
Metals (TAL Subset, Total)	Aluminum, total	6020A	Level IV
	Cadmium, total	6020A	
	Chromium, total	6020A	
	Copper, total	6020A	
	Iron, total	6020A	
	Lead, total	6020A	
	Mercury, total	7470A	
	Nickel, total	6020A	
	Silver, total	6020A	
	Zinc, total	6020A	
Metals (TAL Subset, Dissolved)	Aluminum, dissolved	6020A	Level IV
	Iron, dissolved	6020A	

Footnotes:

[1] Laboratory reporting levels are defined in QAPP Worksheet #15.

Table A-8
Leachate Sampling - Annual Program (Schedule to be Determined)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL[1]
Field Parameters	Color, field	Field	NA
	Conductance, specific	Field	
	pH, field	Field	
	Temperature	Field	
Inorganic Indicators	BOD	5210B	Level IV
	Cyanide, amenable	EPA 335.4	
	Cyanide, total	EPA 335.4	
	Phosphorus, total	EPA 365.4	
	Solids, total suspended	2540D	
Metals (TAL Subset, Total)	Aluminum, total	6020A	Level IV
	Antimony, total	6020A	
	Arsenic, total	6020A	
	Beryllium, total	6020A	
	Cadmium, total	6020A	
	Chromium, total	6020A	
	Copper, total	6020A	
	Iron, total	6020A	
	Lead, total	6020A	
	Mercury, total	7470A	
	Nickel, total	6020A	
	Selenium, total	6020A	
	Silver, total	6020A	
	Thallium, total	6020A	
	Zinc, total	6020A	
Pesticides (TAL)	4,4'-DDD	8081A	Level IV
	4,4'-DDE	8081A	
	4,4'-DDT	8081A	
	Aldrin	8081A	
	Alpha-BHC	8081A	
	Beta-BHC	8081A	
	Chlordane, technical	8081A	
	Delta-BHC	8081A	
	Dieldrin	8081A	
	Endosulfan I	8081A	
	Endosulfan II	8081A	
	Endosulfan sulfate	8081A	
	Endrin	8081A	
	Endrin aldehyde	8081A	
	Gamma-BHC (lindane)	8081A	
	Heptachlor	8081A	
	Heptachlor epoxide	8081A	
	Toxaphene	8081A	

Table A-8 (continued)
Leachate Sampling - Annual Program (Schedule to be Determined)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL[1]
PCBs (TAL)	Aroclor-1016	8082A	Level IV
	Aroclor-1221	8082A	
	Aroclor-1232	8082A	
	Aroclor-1242	8082A	
	Aroclor-1248	8082A	
	Aroclor-1254	8082A	
	Aroclor-1260	8082A	
SVOCs (TAL - Subset)	2,2'-oxybis(1-chloropropane)	8270C	Level IV
	2,4,6-Trichlorophenol	8270C	
	2,4-Dichlorophenol	8270C	
	2,4-Dimethylphenol	8270C	
	2,4-Dinitrophenol	8270C	
	2,4-Dinitrotoluene	8270C	
	2,6-Dinitrotoluene	8270C	
	2-Chloronaphthalene	8270C	
	2-Chlorophenol	8270C	
	2-Nitrophenol	8270C	
	3,3'-Dichlorobenzidine	8270C	
	4,6-Dinitro-2-methylphenol	8270C	
	4-Bromophenyl-phenylether	8270C	
	4-Chloro-3-methylphenol	8270C	
	4-Chlorophenyl-phenylether	8270C	
	4-Nitrophenol	8270C	
	Acenaphthene	8270C-SIM	
	Acenaphthylene	8270C-SIM	
	Anthracene	8270C-SIM	
	Benzo(a)anthracene	8270C-SIM	
	Benzo(a)pyrene	8270C-SIM	
	Benzo(b)fluoranthene	8270C-SIM	
	Benzo(g,h,i)perylene	8270C-SIM	
	Benzo(k)fluoranthene	8270C-SIM	
	Bis(2-chloroethoxy)methane	8270C	
	Bis(2-chloroethyl)ether	8270C	
	Bis(2-ethylhexyl)phthalate	8270C	
	Butylbenzylphthalate	8270C	
	Chrysene	8270C-SIM	
	Dibenz(a,h)anthracene	8270C-SIM	
	Diethylphthalate	8270C	
	Dimethylphthalate	8270C	
	di-n-Butylphthalate	8270C	
	di-n-Octylphthalate	8270C	
	Fluoranthene	8270C-SIM	
	Fluorene	8270C-SIM	
	Hexachlorobenzene	8270C	
	Hexachlorobutadiene	8270C	

Table A-8 (continued)
Leachate Sampling - Annual Program (Schedule to be Determined)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL
SVOCs (TAL - Subset) (continued)	Hexachlorocyclopentadiene	8270C	Level IV
	Hexachloroethane	8270C	
	Indeno(1,2,3-cd)pyrene	8270C-SIM	
	Isophorone	8270C	
	Naphthalene	8270C-SIM	
	Nitrobenzene	8270C	
	n-Nitrosodi-n-propylamine	8270C	
	n-Nitrosodiphenylamine	8270C	
	Pentachlorophenol	8270C	
	Phenanthrene	8270C-SIM	
	Phenol	8270C	
	Pyrene	8270C-SIM	
SVOCs (Additional Parameters)	1,4-Dioxane[2]	EPA 522 Mod.	Level IV
	Benzidine	8270C	
	n-Nitrosodimethylamine	8270C	
VOCs (TAL Subset)	1,1,1-Trichloroethane	8260B	Level IV
	1,1-Dichloroethene	8260B	
	1,2-Dichloroethene, total	8260B	
	Benzene	8260B	
	Bromodichloromethane	8260B	
	Bromoform	8260B	
	Bromomethane	8260B	
	Carbon tetrachloride	8260B	
	Chlorobenzene	8260B	
	Chlorodibromomethane	8260B	
	Chloroethane	8260B	
	Chloroform	8260B	
	Chloromethane	8260B	
	cis-1,3-Dichloropropene	8260B	
	Ethylbenzene	8260B	
	Methylene chloride	8260B	
	Tetrachloroethene	8260B	
	Toluene	8260B	
	trans-1,3-Dichloropropene	8260B	
	Trichloroethene	8260B	
	Vinyl chloride	8260B	
VOCs (Additional Parameters)	2,3-Dichloropropene	8260B	Level IV
	2-Chloroethylvinylether	8260B	
	Acrolein	8260B	
	Acrylonitrile	8260B	
	Fluorotrichloromethane	8260B	
Dioxins/Furans	2,3,7,8-TCDD	1613B	Level IV
	2,3,7,8-TCDF	1613B	

Footnotes:

(1) Laboratory reporting levels are defined in QAPP Worksheet #15.

(2) Parameter/parameter group may be removed from the sampling program after 2 consecutive annual monitoring events, pending evaluation.

Table A-9
Landfill Gas Monitoring - Annual Program (November)
Lemberger Landfill and Lemberger Transport and Recycling Sites
Town of Franklin, Wisconsin

PARAMETER GROUP	PARAMETER	METHOD	LABORATORY REPORTING LEVEL
Field Parameters	Barometric pressure trend	Field	NA
	Methane, percent by volume	Field	
	Methane, percent of LEL	Field	
	Oxygen, percent by volume	Field	
	Pressure, barometric	Field	

Attachment 2
Long Term Monitoring
Standard Operating Procedures

Table of Contents

Groundwater Sampling and Field Measurement Procedures

Standard Operating Procedure F-1
Groundwater Sampling and Field Measurement Procedures

This standard operating procedure (SOP) sets forth the field procedures for the sampling of groundwater. The procedures include monitoring well inspection, groundwater elevation measurement, decontamination of nondedicated sampling equipment, and groundwater sampling.

Monitoring Well Inspection

The condition of the monitoring wells will be inspected and documented during each sampling event prior to the collection of data. The following information will be noted on a monitoring well inspection form:

- The ground surface condition around the well (vegetation, safety hazards, access hazards, etc.)
- Well security features (presence of lock, lock key number, protective bollards, paint, visibility devices, evidence of tampering, traffic hazards, etc.)
- Condition of the well surface completion, including surface protector, protective cover, inner casing cap or plug, and concrete pad
- Evidence of potential contamination at the wellhead, including staining or suspicious containers

Groundwater Elevation Measurement

In order to determine the static water elevation (SWE), the static water level (SWL) will be measured prior to purging and sampling at each monitoring well in the sampling program. All static water level measurements will be obtained on the first day of the sampling event or within a 24-hour period. The measurements will be obtained prior to purging the monitoring wells for water quality sampling. Each well has a top-of-casing (TOC) reference point marked on it, from which all water level measurements will be taken. The vertical reference points have been surveyed to the nearest 0.01 foot and referenced to the local coordinate system.

Decontamination Procedures for Non-dedicated Sampling Equipment

Proper decontamination of sampling equipment is essential to minimize the possibility of cross-contamination of samples. Non-dedicated equipment used for sampling various environmental

media (soil, groundwater, surface water, etc.) will be cleaned before its initial use in the field and again before use at each subsequent sampling site.

All non-dedicated sampling equipment will be new, or will be decontaminated at TRC prior to its initial use on-site. Decontamination procedures will include the following steps:

1. Wash the equipment in a nonphosphate detergent.
2. Rinse with potable tap water.
3. Rinse with deionized (DI) or distilled water.

Non-dedicated equipment that is to be used at additional locations at the site will be field-decontaminated between sampling locations. The field decontamination of sampling equipment will take place at the sampling location. All decontamination water will be containerized and disposed of in an appropriate manner. Disposal options may include temporary storage in appropriate vessels at the site (pending analysis for disposal), disposed of to an on-site wastewater treatment system, or pre-arranged transport to an off-site disposal facility.

To the extent practicable, single-use sampling equipment and materials will be used for the collection of all environmental samples. The materials used will be new and clean, and will be placed in plastic for transport to the site. Once used, this equipment will be placed in plastic bags and managed as investigation-derived waste material.

Groundwater Sampling Procedures – Monitoring, Leachate Head, and Extraction Wells

Wells that Do Not Purge Dry

Groundwater samples will be collected from the selected monitoring wells using a low-flow pumping technique. This sampling method involves purging the well with the pump intake set at the desired sampling depth at a rate that should not mobilize naturally nonmobile colloidal matter, that does not create excessive water level drawdown, that minimizes pressure changes in the purged water, and that does not appreciably change the redox state of the sample. This sampling method minimizes the disturbance of the sample, thereby reducing sampling artifacts, and improves the consistency and quality of the groundwater sample results. In addition, the low-flow sampling method significantly reduces the volume of potentially contaminated purge water generated during the sampling process. In general, low-flow purging and sampling methods developed by USEPA (USEPA, 1996) will be followed.

Each monitoring well will be pumped using a stainless steel bladder pump and disposable LDPE tubing. A submersible electric pump such as a Grundfos™ a Keck™, or a Whale™ pump with dedicated LDPE or HDPE tubing may be used instead of a bladder pump in the event that the depth to water exceeds the limitations of the bladder pump.

Flexible plastic products (such as plastic tubing) have been known to contain plasticizers (such as bis[2-ethylhexyl]phthalate [BEHP]) that can leach from the plastic into water as the plastic degrades. Use of such tubing may cause contamination of groundwater samples. Low density polyethylene (LDPE) is generally considered to be BEHP-free, and is the current industry standard for general groundwater sampling. In addition, by using disposable tubing and replacing it for every monitoring event, the tubing has less opportunity to degrade, and is less likely to release contaminants to the well water. Dedicated tubing that is installed in wells with dedicated pumps has been in contact with the well water for an extended period of time; however, purging flow rates at these wells generally result in the removal of more than 1 well volume of water prior to sampling and thus the potential for sample contamination is minimized. The sampling results following the first annual sampling event will be evaluated to determine if dedicated tubing needs to be replaced.

The submersible pump intake will be placed approximately 1 to 2 feet above the base of the well screen, and the well will be pumped at a flowrate ranging from 0.2 to 1.0 liter/minute. The pumping rate for each monitoring well is dependent on the hydraulic properties of the formation the well is screened across, and will be determined in the field to be the highest flowrate attainable without creating drawdown greater than approximately 0.1 meter, or at a minimum of 200 mL/minute. In the event that the aquifer transmissivity is too low to yield sufficient water to limit drawdown to 0.1 meter at the lowest specified pumping rate (0.2 liter/minute), sampling will be conducted at the 0.2 liter/minute rate since this is the minimum flowrate necessary for accurate measurements through the flow-through cell, and to prevent water from freezing in the discharge lines during the winter months.

In wells where a dedicated Grundfos™ pump is installed (or other electric submersible pump is required), the flow rate may exceed 1.0 liter per minute due to the pump specifications. Care will be taken to minimize the flow rate, and ensure stability of chemical parameters and water level prior to sampling.

A Geotech P3 flow-through cell (or equivalent) equipped with temperature, redox potential, dissolved oxygen, specific electrical conductance, and pH electrodes will be connected to the discharge tubing from the peristaltic pump. Turbidity measurements will be collected from the pump discharge tubing using a HACH 2100P turbidity meter (or equivalent). Each of these parameters will be measured at each well during purging to evaluate stabilization. Wells will be considered stable when the following conditions apply between three successive 1-liter sampling intervals:

- The temperature change is within 0.5°C.
- The conductance change is within 3% .
- The turbidity change is ± 10 percent or the reading is below <10 NTUs.
- The dissolved oxygen change is within 0.5 mg/L.
- The redox (E_H) change is within 20 mV.
- The pH change is within 0.1 pH units.
- The water level drawdown is within 0.16 ft in a 2" diameter well (or 0.04 ft in a 4" diameter well) for every liter of water removed (or less than 10 percent of the water purged resulting from drawdown).

The wells will be sampled immediately following stabilization. The samples will be taken from the pump discharge after the flow-through cell has been disconnected.

In the event that stabilization of the indicator parameters is not achieved in a reasonable amount of time (2 hours), the well may be sampled after four well volumes of water have been removed. As with the low-flow purging and sampling technique, the purging and sampling rates should also be kept low and should not exceed the natural flow conditions of the aquifer, if possible.

Wells that Purge Dry

If a well cannot sustain a pumping rate of 200 mL/minute, and can be purged dry at that flow rate, the well will be purged dry and allowed to recover prior to sampling. If a well can be purged dry, the well will be evacuated and allowed to recover prior to sampling, but for no more than 24 hours after purging.

Bailers (HDPE) may be used as a last resort to purge and sample wells in the event that a well cannot be accessed with other equipment. When wells are purged with a bailer, a minimum of three well volumes to a maximum of five well volumes will be removed prior to sampling.

Regardless of the sampling technique used, efforts will be made to minimize agitation/disturbance of samples during purging and sampling activities. Likewise, efforts will be made to avoid purging wells dry.

Groundwater Sampling Procedures – Residential Wells

Groundwater samples will be collected from residential wells from a sample tap located as close to the well as possible, and before any treatment systems or pressure tanks. The sample tap will be purged for a minimum of 5 minutes prior to collecting the groundwater sample.

Equipment Operation & Maintenance

Calibration Procedures

The pH, ORP, specific conductance, turbidity, and dissolved oxygen meters will be calibrated daily in accordance with manufacturer's instructions. Calibration information will be recorded in the field logbook.

Operation Procedures

The sampling pump, flow-through cell, and meters will be operated according to the manufacturer's instructions.

Maintenance Procedures

The sampling pump, flow-through cell, and meters will be maintained according to the manufacturer's instructions. Maintenance information will be recorded in the field logbook. Replacement sampling pumps, flow-through cells, and meters will be available on-site or ready for overnight shipment, as necessary.

IDW Management

Investigation Derived Waste

Groundwater pumped during purging, tubing, and other general waste materials generated by the sampling will be collected and managed as investigation-derived waste materials as described in the Sampling and Analysis Plan.

Sample Handling and Chain of Custody

All samples will be stored on ice immediately after collection. Field personnel will be aware of the holding times for specific parameters and will make arrangements to have the samples delivered to the laboratory to meet these holding times. Samples will remain in the custody of the field sampling team until shipped.

This Chain-of-Custody documentation enables possession of a sample to be traced from sample collection through analysis and disposal. A Chain-of-Custody protocol will be established to document control of the samples from the point of collection to delivery to the analytical laboratory. Samples will be under the custody of a designated person at all times. The control of custody will be documented on a Chain-of-Custody form supplied by the laboratory. The Chain-of-Custody form will document the names, signatures, and affiliations of personnel in custody of the samples, and the dates and times custody was transferred. The sampling personnel will be responsible for sample custody in the field. The laboratory sample custodian and analysts will be responsible for custody of the sample at the laboratory.

A copy of the Chain-of-Custody form will be placed in the project files, and the original will accompany the samples to the laboratory. The identity of field duplicate samples will not be disclosed to the analytical laboratory. Sample analysis request forms will be prepared by sampling personnel and reviewed by the project coordinator or project manager. The analytical request forms will either accompany the samples to the laboratory or will precede the delivery of samples to the laboratory.

Shipping containers will be sealed and will be accompanied by the Chain-of-Custody form, with appropriate signatures. The transfer of custody is the responsibility of the sampling personnel and the laboratory staff. The procedures to be implemented are as follows:

- Place completed chain-of-custody forms in a plastic bag, seal the bag, and tape it to the inside cover of the shipping container.
- After the samples are iced, seal the coolers with strapping tape and custody seals (if applicable), add the date to the custody seals, and ship the coolers to the laboratory using overnight delivery or by delivering them directly to the laboratory.
- Identify common carriers or intermediate individuals on the Chain-of-Custody form, and retain copies of all bills-of-lading.
- When the samples are received in the laboratory, handle and process them in accordance with the procedures in the laboratory's standard operating procedures (SOPs), or specified analytical methods.

In the laboratory, a sample custodian will be assigned to receive the samples. Upon receipt of the samples, the custodian will inspect the condition of the samples, reconcile the samples received against the Chain-of-Custody form, check the temperature of the samples, log the samples in the laboratory log book, and store the samples in a secured sample storage room or cabinet maintained at an appropriate temperature until assigned to an analyst for analysis. Custody will be maintained until the samples are discarded.

When samples requiring preservation by either acid (except samples for VOC analysis) or base are received at the laboratory, the pH will be measured and documented. The laboratory sample custodian will adjust the pH, if necessary, and will notify the laboratory Quality Assurance/Quality Control (QA/QC) Coordinator of the pH adjustment so that sample collection procedures can be reviewed to determine if a modification is necessary.

Discrepancies observed between the samples received, the information on the Chain-of-Custody form, and the sample analysis request sheet will be resolved before the sample is assigned for analysis. The laboratory QA/QC Coordinator will be informed of any such discrepancy, as well as its resolution. Results of the inspection will be documented in the laboratory sample logbook. Discrepancies will be documented in the analytical case narrative, as appropriate.

References

USEPA. 1996. Low-flow (minimal drawdown) ground-water sampling procedures. EPA/540/S-95/504. April 1996.

Landfill Gas Measurements

Standard Operating Procedure F-2
Landfill Gas Measurements

This standard operating procedure (SOP) is applicable to the performance of landfill gas measurements. The methodologies discussed in this SOP are generic in nature and may be modified in whole or part to meet the handling and analytical requirements of the contaminants of concern, as well as the constraints presented by site conditions and equipment limitations. Modifications of sampling methodologies will be documented in the appropriate field logbook and discussed in reports summarizing field activities and analytical results.

Gas Vents and Probes

Gas vents and probes will be sampled in the following manner:

- Clean off the vent opening and sampling port, as needed.
- When sampling an open vent, cover and seal the top of the vent to isolate the sampling port from ambient air.
- Connect the Landtech gas meter (or equivalent sampling device) to the sampling port, and purge the vent until readings stabilize. Each sampling point must be purged for a minimum of 2 minutes prior to taking a reading.
- Record the readings in a field notebook
- Disconnect the gas meter, and remove the vent cover seal as appropriate.

Example Field Forms

PROJECT NAME: _____

PROJECT NUMBER: _____

PROJECT MANAGER: _____

SITE LOCATION: _____

_____

DATES OF FIELDWORK: _____ TO _____

PURPOSE OF FIELDWORK: _____

_____

_____

_____

_____

WORK PERFORMED BY: _____

_____

_____

_____

_____

_____ _____

SIGNED DATE CHECKED BY DATE

REVISED 03/2008

TRC

GENERAL NOTES

PROJECT NAME: 0	DATE:	TIME ARRIVED:
PROJECT NUMBER: 0.00	AUTHOR: 0	TIME LEFT:

WEATHER		
TEMPERATURE: _____ °F	WIND: _____ MPH	VISIBILITY: _____

WORK / SAMPLING PERFORMED

PROBLEMS ENCOUNTERED	CORRECTIVE ACTION TAKEN

COMMUNICATION		
NAME	REPRESENTING	SUBJECT / COMMENTS

SIGNED _____ DATE _____

CHECKED BY _____ DATE _____

TRC

WATER LEVEL DATA

PROJECT NAME: 0	DATE:
PROJECT NUMBER: 0.00	AUTHOR: 0

WELL LOCATION	TIME	REFERENCE	DEPTH TO WATER (FEET)	DEPTH TO BOTTOM (FEET)	DEPTH TO PRODUCT (FEET)	WATER ELEVATION

ALL WATER LEVELS MUST INCLUDE REFERENCE POINT AND TAPE CORRECTION FACTOR (E.G., 1.1 + 0.00 T/PVC).

SIGNED _____ DATE _____

CHECKED _____ DATE _____

TRC

WELL INSPECTION REPORT

PROJECT NAME: 0	SAMPLER NAME: 0
PROJECT NO.: 0.00	DATE:

WELL ID	PROTECTIVE CASING	SURFACE SEAL	DEGREE OF IMMOBILITY OF PROTECTIVE CASING	PERMANENT LEGIBLE LABELS	LOCK	WELL CAP	EASE OF INSERTING / REMOVING BAILER	SEDIMENT IN WELL	COMMENT

SIGNED DATE

CHECKED BY DATE

REVISED 03/2008

METER CALIBRATION

PROJECT NAME:	0	MODEL:	SAMPLER
PROJECT NO.:	0.00	SERIAL #:	DATE:

PH CALIBRATION CHECK

METER CHECK	BUFFER CHECK	TIME

Buffer Lot Numbers: pH 4:_____ pH 7: _____

CONDUCTIVITY METER

SOLUTION TEMPERATURE	CORRECTED COND. @ 25°C	TIME

Calibration Solution Lot #:_____

D.O. CALIBRATION CHECK

CALIBRATION READING (mg/L)	TIME

REDOX METER

TEMP. °C	ORP (mV)	TIME

Calibration Solution Lot #:_____

Solution Range: 225 - 250 mV

TURBIDITY METER

GEL VALUE (NTU)	READING (NTU)		TIME
0-10 RANGE			
0-100 RANGE			
0-1000 RANGE			
0-10 RANGE			
0-100 RANGE			
0-1000 RANGE			

COMMENTS

SIGNED DATE

CHECKED BY DATE

TRC

WATER SAMPLE LOG

PROJECT NAME: 0 .	PREPARED		CHECKED	
PROJECT NUMBER: 0.00	BY: LJB	DATE:	BY:	DATE:

SAMPLE ID:	WELL DIAMETER: ☑ 2"	☐ 4"	☐ 6"	☐ OTHER		
WELL MATERIAL:	☑ PVC	☐ SS	☐ IRON	☐ GALVANIZED STEEL	☐ OTHER	
SAMPLE TYPE:	☑ GW	☐ WW	☐ SW	☐ DI	☐ LEACHATE	☐ OTHER

PURGING	TIME:	DATE:	SAMPLE	TIME:	DATE:
PURGE METHOD:	☑ PUMP	BLADDER PUMP (QED)	PH: _____ SU	CONDUCTIVITY: _____	umhos/cm
	☐ BAILER	_____	ORP: _____ mV	DO: _____	mg/L
DEPTH TO WATER: _____ T/ PVC			TURBIDITY:		
DEPTH TO BOTTOM: NA T/ PVC			☐ NONE ☐ SLIGHT ☐ MODERATE ☐ VERY		
WELL VOLUME: NA	☐ LITERS	☐ GALLONS	TEMPERATURE: _____ °C	OTHER: _____	
VOLUME REMOVED: _____	☑ LITERS	☐ GALLONS	COLOR: _____	ODOR: _____	
COLOR: _____	ODOR: _____		FILTRATE (0.45 um) ☐ YES	☑ NO	
TURBIDITY			FILTRATE COLOR: _____	FILTRATE ODOR: _____	
☐ NONE ☐ SLIGHT ☐ MODERATE ☐ VERY			QC SAMPLE: ☐ MS/MSD	☐ DUP- _____	
DISPOSAL METHOD: ☐ GROUND ☐ DRUM ☑ OTHER			COMMENTS:		

TIME	PURGE RATE (ML/MIN)	PH (SU)	CONDUCTIVITY (umhos/cm)	ORP (mV)	D.O. (mg/L)	[redacted]	TEMPERATURE (°C)	WATER LEVEL (FEET)	CUMULATIVE PURGE VOLUME (GAL OR L)
									INITIAL

BOTTLES FILLED		PRESERVATIVE CODES A - NONE B - HNO3 C - H2SO4 D - NaOH E - HCL F - _____							
NUMBER	SIZE	TYPE	PRESERVATIVE	FILTERED	NUMBER	SIZE	TYPE	PRESERVATIVE	FILTERED
3	40 mL	VOA	E	☐ Y ☑ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N

SHIPPING METHOD: Courier	DATE SHIPPED: _____	AIRBILL NUMBER: _____
	SIGNATURE: _____	DATE SIGNED: _____

REVISED 03/2008

TRC

WATER SAMPLE LOG

(CONTINUED FROM PREVIOUS PAGE)

PROJECT NAME: 0	PREPARED		CHECKED	
PROJECT NUMBER: 0.00	BY: LJB	DATE:	BY:	DATE:

SAMPLE ID:

TIME	PURGE RATE (ML/MIN)	PH (SU)	CONDUCTIVITY (umhos/cm)	ORP (mV)	D.O. (mg/L)	TURBIDITY (NTU)	TEMPERATURE (°C)	WATER LEVEL (FEET)	CUMULATIVE PURGE VOLUME (GAL OR L)

SIGNATURE: _____ DATE SIGNED: _____

Attachment 3
Laboratory Accuracy and Precision Objectives

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8260 Water

				LCS/LCSD 05/25/10			MS/MSD 05/25/10			DUP
#	Analyte	True MDL (ug/L)	PRL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	1,1,1,2-Tetrachloroethane	0.92	1	70	130	20	70	130	20	
2	1,1,1-Trichloroethane	0.90	1	70	132	20	70	132	20	
3	1,1,2,2-Tetrachloroethane	0.20	1	63	130	20	61	130	20	
4	1,1,2-Trichloroethane	0.42	1	70	130	20	70	130	20	
5	1,1,2-Trichlorotrifluoroethane	1.29	5	50	150	20	50	150	20	
6	1,1-Dichloroethane	0.75	1	70	132	20	70	132	20	
7	1,1-Dichloroethene	0.57	1	70	137	20	70	137	20	
8	1,1-Dichloropropene	0.75	1	70	130	20	70	130	20	
9	1,2,3-Trichlorobenzene	0.74	1	70	130	20	70	130	20	
10	1,2,3-Trichloropropane	0.99	1	70	130	20	70	130	20	
11	1,2,3-Trimethylbenzene	0.84	1	70	130	20	70	130	20	
12	1,2,4-Trichlorobenzene	0.97	1	70	130	20	70	130	20	
13	1,2,4-Trimethylbenzene	0.97	1	70	130	20	70	130	20	
14	1,2-Dibromo-3-chloropropane	1.68	5	50	150	20	50	150	20	
15	1,2-Dibromoethane (EDB)	0.56	1	70	130	20	70	130	20	
16	1,2-Dichlorobenzene	0.83	1	70	130	20	70	130	20	
17	1,2-Dichloroethane	0.36	1	70	130	20	70	133	20	
18	1,2-Dichloroethene (Total)	1.40	2	70	130	20	70	130	20	
19	1,2-Dichloropropane	0.49	1	70	130	20	70	130	20	
20	1,3,5-Trimethylbenzene	0.83	1	70	130	20	70	130	20	
21	1,3-Dichlorobenzene	0.87	1	70	130	20	70	130	20	
22	1,3-Dichloropropane	0.61	1	70	130	20	70	130	20	
23	1,4-Dichlorobenzene	0.95	1	70	130	20	70	130	20	
24	1,4-Dioxane (p-Dioxane)	103.14	250	50	150	20	50	150	20	
25	2,2-Dichloropropane	0.62	1	70	130	20	70	130	20	
26	2,3-Dichloropropene	0.84	1	70	130	20	70	130	20	
27	2-Butanone (MEK)	4.30	20	50	150	20	50	150	20	
28	2-Chloroethylvinyl ether	0.95	1	70	130	20	70	130	20	
29	2-Chlorotoluene	0.85	1	70	130	20	70	130	20	
30	2-Hexanone	1.97	5	50	150	20	50	150	20	
31	2-Methylnaphthalene	1.40	5	50	150	20	50	150	20	

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8260 Water

				LCS/LCSD 05/25/10			MS/MSD 05/25/10			DUP
#	Analyte	True MDL (ug/L)	PRL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
32	2-Propanol	19.99	250	50	150	20	50	150	20	
33	4-Chlorotoluene	0.74	1	70	130	20	70	130	20	
34	4-Methyl-2-pentanone (MIBK)	1.20	5	50	150	20	50	150	20	
35	Acetone	4.99	20	50	150	20	50	150	20	
36	Acetonitrile	3.30	20	50	150	20	50	150	20	
37	Acrolein	10.00	10	50	150	20	50	150	20	
38	Acrylonitrile	1.30	5	50	150	20	50	150	20	
39	Allyl chloride	2.00	5	50	150	20	50	150	20	
40	Benzene	0.41	1	70	130	20	70	130	20	
41	Bromobenzene	0.85	1	70	130	20	70	130	20	
42	Bromochloromethane	0.97	1	70	130	20	70	130	20	
43	Bromodichloromethane	0.56	1	70	131	20	70	131	20	
44	Bromoform	0.94	1	70	130	20	68	130	20	
45	Bromomethane	0.91	1	53	160	20	47	177	20	
46	Carbon disulfide	0.66	1	70	130	20	60	130	29	
47	Carbon tetrachloride	0.49	1	70	130	20	70	149	20	
48	Chlorobenzene	0.41	1	70	130	20	70	130	20	
49	Chloroethane	0.97	1	70	147	20	66	147	20	
50	Chloroform	1.30	5	70	130	20	70	130	20	
51	Chloromethane	0.24	1	41	137	20	41	137	20	
52	Chloroprene	0.67	20	50	150	20	50	150	20	
53	Cyclohexane	1.02	5	50	150	20	50	150	20	
54	Cyclohexanone	17.51	50	50	150	20	50	150	20	
55	Dibromochloromethane	0.81	1	70	130	20	70	130	20	
56	Dibromomethane	0.60	1	70	130	20	70	130	20	
57	Dichlorodifluoromethane	0.99	1	50	150	20	50	150	20	
58	Dichlorofluoromethane	0.88	1	50	150	20	50	150	20	
59	Diethyl ether (Ethyl ether)	0.98	1	70	130	20	70	130	20	
60	Diisopropyl ether	0.76	1	70	130	20	70	130	20	
61	Ethanol	47.31	200	50	150	20	50	150	20	
62	Ethyl acetate	13.83	50	50	150	20	50	150	20	

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8260 Water

				LCS/LCSD 05/25/10			MS/MSD 05/25/10			DUP
#	Analyte	True MDL (ug/L)	PRL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
63	Ethyl methacrylate	1.64	5	50	150	20	50	150	20	
64	Ethyl-tert-butyl ether	1.24	5	70	130	20	70	130	20	
65	Ethylbenzene	0.54	1	70	130	20	70	130	20	
66	Hexachloro-1,3-butadiene	0.67	5	70	130	20	70	130	20	
67	Hexachloroethane	0.87	1	50	150	20	50	150	20	
68	Iodomethane	2.50	5	50	150	20	50	150	20	
69	Isoamyl acetate	1.00	5	50	150	20	50	150	20	
70	Isobutanol	15.65	50	50	150	20	50	150	20	
71	Isopropyl acetate	1.65	5	50	150	20	50	150	20	
72	Isopropylbenzene (Cumene)	0.59	1	70	130	20	70	130	20	
73	Methacrylonitrile	1.97	20	50	150	20	50	150	20	
74	Methyl acetate	2.95	10	50	150	20	50	150	20	
75	Methyl methacrylate	1.95	5	50	150	20	50	150	20	
76	Methyl-tert-butyl ether	0.61	1	70	130	20	70	130	20	
77	Methylcylohexane	1.90	5	50	150	20	50	150	20	
78	Methylene Chloride	0.43	1	70	130	20	70	130	20	
79	Naphthalene	0.89	5	70	130	20	70	130	20	
80	Propionitrile	4.93	20	50	150	20	50	150	20	
81	Propyl Acetate	0.32	5	50	150	20	50	150	20	
82	Styrene	0.86	1	70	130	20	13	149	20	
83	Tetrachloroethene	0.45	1	70	130	20	70	130	20	
84	Tetrahydrofuran	1.70	5	50	150	20	50	150	20	
85	Toluene	0.67	1	70	130	20	70	130	20	
86	Total Trimethylbenzenes	0.97	2	70	130	20	70	130	20	
87	Trichloroethene	0.48	1	70	130	20	70	130	20	
88	Trichlorofluoromethane	0.79	1	50	150	20	50	150	20	
89	Vinyl acetate	1.60	5	50	150	20	50	150	20	
90	Vinyl chloride	0.18	1	47	131	20	46	131	20	
91	Xylene (Total)	2.60	3	70	130	20	70	130	20	
92	cis-1,2-Dichloroethene	0.83	1	70	130	20	70	130	20	
93	cis-1,3-Dichloropropene	0.20	1	70	130	20	70	130	20	

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302
920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8260 Water

				LCS/LCSD 05/25/10			MS/MSD 05/25/10			DUP
#	Analyte	True MDL (ug/L)	PRL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
94	cis-1,4-Dichloro-2-butene	2.64	5	50	150	20	50	150	20	
95	m&p-Xylene	1.80	2	70	130	20	70	130	20	
96	n-Butanol	56.98	250	50	150	20	50	150	20	
97	n-Butyl acetate	0.98	5	50	150	20	50	150	20	
98	n-Butylbenzene	0.93	1	70	130	20	70	130	20	
99	n-Heptane	1.52	5	50	150	20	50	150	20	
100	n-Hexane	0.95	5	50	150	20	50	150	20	
101	n- Propanol	96.59	250	50	150	20	50	150	20	
102	n-Propylbenzene	0.81	1	70	130	20	70	130	20	
103	n-amyl acetate	1.60	5	50	150	20	50	150	20	
104	o-Xylene	0.83	1	70	130	20	70	130	20	
105	p-Isopropyltoluene	0.67	1	70	130	20	70	130	20	
106	sec-Butylbenzene	0.89	5	70	130	20	70	130	20	
107	tert-Amylmethyl ether	0.17	1	70	130	20	70	130	20	
108	tert-Butyl Alcohol	7.34	25	50	150	20	50	150	20	
109	tert-Butylbenzene	0.97	1	70	130	20	70	130	20	
110	trans-1,2-Dichloroethene	0.89	1	70	130	20	70	130	20	
111	trans-1,3-Dichloropropene	0.19	1	70	130	20	70	130	20	
112	trans-1,4-Dichloro-2-butene	1.10	5	50	150	20	50	150	20	
#	Surrogates 05/25/10									
1	4-Bromofluorobenzene (S)			69	130					
2	Dibromofluoromethane (S)			70	134					
3	Toluene-d8 (S)			70	130					

eo, sw, sv, eb

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc
Method Detection Limits and Reporting Limits
for EPA 8270 Water 3510C

		1/30/07	7/8/09	LCS/LCSD 6/28/2010			MS/MSD 6/28/2010			DUP
#	Analyte	True MDL (ug/L)	PQL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	1,2,4-Trichlorobenzene	0.87	5	58	130	21	50	130	21	
2	1,2-Dichlorobenzene	0.71	5	51	130	24	42	130	26	
3	1,2-Diphenylhydrazine	1.61	5	67	130	20	66	130	20	
4	1,3-Dichlorobenzene	0.83	5	45	130	26	39	130	29	
5	1,4-Dichlorobenzene	0.86	5	46	130	26	42	130	29	
6	1,4-Dioxane (p-Dioxane)	3.45	20	10	130	20	10	130	20	
7	1-Methylnaphthalene	1.04	5	68	130	20	68	130	20	
8	2,2'-Oxybis(1-chloropropane)	0.82	5	44	130	20	43	135	20	
9	2,3,4,6-Tetrachlorophenol	2.32	5	70	130	20	70	130	20	
10	2,4,5-Trichlorophenol	1.00	5	70	130	20	62	130	20	
11	2,4,6-Trichlorophenol	1.07	5	70	130	20	58	130	20	
12	2,4-Dichlorophenol	1.15	5	63	130	20	50	130	20	
13	2,4-Dimethylphenol	1.13	5	14	130	28	10	151	32	
14	2,4-Dinitrophenol	2.06	10	45	130	20	45	133	20	
15	2,4-Dinitrotoluene	0.80	5	70	130	20	56	138	20	
16	2,6-Dinitrotoluene	1.07	5	70	130	20	51	137	20	
17	2-Chloronaphthalene	0.84	5	70	130	20	57	130	20	
18	2-Chlorophenol	0.70	5	54	130	20	40	130	20	
19	2-Methylnapthalene	1.35	5	70	130	20	58	130	20	
20	2-Methylphenol(o-Cresol)	0.97	5	45	130	20	29	130	20	
21	2-Nitroaniline	0.84	5	63	136	20	29	153	20	
22	2-Nitrophenol	1.36	5	65	130	20	46	130	20	
23	3&4-Methylphenol(m&p Cresol)	0.77	5	40	130	20	29	130	21	
24	3,3'-Dichlorobenzidine	1.11	5	39	138	21	10	138	44	
25	3-Nitroaniline	0.97	5	69	130	20	24	131	20	
26	4,6-Dinitro-2-methylphenol	0.75	5	56	130	20	52	130	20	
27	4-Bromophenylphenyl ether	1.30	5	63	130	20	62	130	20	
28	4-Chloro-3-methylphenol	1.01	5	64	130	20	42	130	20	
29	4-Choloraniline	0.81	5	48	130	23	29	130	28	
30	4-Chlorophenylphenyl ether	1.19	5	70	130	20	69	130	20	
31	4-Nitroaniline	1.10	5	53	140	21	21	140	28	
32	4-Nitrophenol	0.87	10	10	130	22	10	130	35	
33	Acenaphthene	0.95	5	70	130	20	65	130	20	

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc
Method Detection Limits and Reporting Limits
for EPA 8270 Water 3510C

		1/30/07	7/8/09	LCS/LCSD 6/28/2010			MS/MSD 6/28/2010			DUP
#	Analyte	True MDL (ug/L)	PQL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
34	Acenaphthylene	1.00	5	70	130	20	69	130	20	
35	Acetophenone	1.73	10	70	130	20	70	130	20	
36	Aniline	1.55	5	10	130	20	10	130	20	
37	Anthracene	0.63	5	70	130	20	68	130	20	
38	Atrazine	1.80	10	70	130	20	70	130	20	
39	Benzaldehyde	1.40	10	70	130	20	70	130	20	
40	Benzidine	8.93	50	10	130	20	10	130	20	
41	Benzo(a)anthracene	0.61	5	70	130	20	60	130	20	
42	Benzo(a)pyrene	0.97	5	67	130	20	45	130	20	
43	Benzo(b)fluoranthene	1.44	5	70	130	20	45	135	20	
44	Benzo(g,h,i)perylene	0.77	5	43	140	32	37	140	45	
45	Benzo(k)fluoranthene	1.02	5	70	130	20	53	132	24	
46	Benzoic acid	2.67	10	10	130	20	10	130	20	
47	Benzyl alcohol	1.26	10	55	130	20	50	130	20	
48	Biphenyl (Diphenyl)	1.46	10	70	130	20	70	130	20	
49	Butylbenzylphthalate	1.09	5	66	143	20	37	158	20	
50	Caprolactam	1.44	10	10	130	20	10	130	20	
51	Carbazole	0.69	5	70	130	20	70	130	20	
52	Chrysene	0.78	5	70	130	20	64	130	20	
53	Cresols (Total)	1.17	5	10	150	20	10	150	20	
54	Di-n-butylphthalate	0.90	5	70	130	20	63	130	20	
55	Di-n-octylphtalate	1.53	5	70	135	20	51	150	20	
56	Dibenz(a,h)anthracene	1.38	5	48	132	20	39	132	41	
57	Dibenzofuran	1.06	5	70	130	20	70	130	20	
58	Diethylphthalate	1.35	5	70	130	20	50	130	20	
59	Dimethylphtalate	1.04	5	70	130	20	70	130	20	
60	Fluoranthene	0.91	5	60	130	20	55	130	20	
61	Fluorene	1.14	5	70	130	20	70	130	20	
62	Hexachloro-1,3-butadiene	0.66	10	47	130	21	39	130	26	
63	Hexachlorobenzene	1.11	5	66	130	20	58	130	20	
64	Hexachlorocyclopentadiene	1.10	5	10	130	29	10	130	50	
65	Hexachloroethane	0.58	5	39	130	30	24	130	45	
66	Indeno(1,2,3-cd)pyrene	0.67	5	42	146	35	27	146	50	

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc
Method Detection Limits and Reporting Limits
for EPA 8270 Water 3510C

		1/30/07	7/8/09	LCS/LCSD 6/28/2010			MS/MSD 6/28/2010			DUP
#	Analyte	True MDL (ug/L)	PQL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
67	Isophorone	1.37	5	24	130	20	23	130	20	
68	N-Nitroso-di-n-propylamine	1.06	5	56	130	20	44	134	20	
69	N-Nitrosodimethylamine	0.60	5	35	130	20	24	130	20	
70	N-Nitrosodiphenylamine	2.45	10	66	130	25	59	134	25	
71	Naphthalene	0.70	5	66	130	20	48	130	20	
72	Nitrobenzene	1.37	5	62	130	20	52	130	20	
73	Pentachlorophenol	1.08	10	44	130	20	44	130	20	
74	Phenanthrene	0.63	5	70	130	20	66	130	20	
75	Phenol	1.03	5	23	130	23	19	130	23	
76	Pyrene	1.61	5	44	156	20	33	163	28	
77	Pyridine	1.43	5	10	130	20	10	130	20	
78	bis(2-Chloroethoxy)methane	1.19	5	70	130	20	68	130	20	
79	bis(2-Chloroethyl) ether	0.66	5	54	130	20	48	130	20	
80	bis(2-Ethylhexyl)phthalate	2.60	5	70	137	20	34	160	20	

#	Surrogates				
1	2,4,6-Tribromophenol (S)			44	130
2	2-Fluorobiphenyl (S)			56	130
3	2-Fluorophenol (S)			26	130
4	Nitrobenzene-d5 (S)			54	131
5	Phenol-d5 (S)			18	130
6	Terphenyl-d14 (S)			52	130

ck/cf

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc
Method Detection Limits and Reporting Limits
for 8270 SIM Water 3510C

		6/8/09	2/12/07	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (ug/kg)	PQL (ug/kg)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	1-Methylnaphthalene	0.00530	0.05	33	130	46	10	130	45	
2	2-Methylnaphthalene	0.00409	0.05	29	130	44	10	130	44	
3	Acenaphthene	0.00480	0.05	43	130	46	25	130	41	
4	Acenaphthylene	0.00382	0.05	33	130	47	22	130	40	
5	Anthracene	0.00608	0.05	33	130	50	22	130	36	
6	Benzo(a)anthracene	0.00384	0.05	41	130	20	52	130	20	
7	Benzo(a)pyrene	0.00303	0.05	59	130	20	52	130	20	
8	Benzo(b)fluoranthene	0.00300	0.05	53	130	20	51	130	20	
9	Benzo(g,h,i)perylene	0.00360	0.05	55	130	20	46	130	20	
10	Benzo(k)fluoranthene	0.00463	0.05	64	133	20	55	130	22	
11	Chrysene	0.00369	0.05	62	130	20	49	130	20	
12	Dibenz(a,h)anthracene	0.00339	0.05	37	130	20	43	130	20	
13	Fluoranthene	0.00467	0.05	48	130	37	41	130	28	
14	Fluorene	0.00506	0.05	42	130	48	21	130	32	
15	Indeno(1,2,3-cd)pyrene	0.00496	0.05	46	130	20	42	130	20	
16	Naphthalene	0.00514	0.05	33	130	53	19	130	42	
17	Phenanthrene	0.00858	0.05	36	130	47	22	130	38	
18	Pyrene	0.00503	0.05	51	130	33	35	130	21	

#	Surrogates				
1	2-Fluorobiphenyl (S)			25	130
2	Nitrobenzene-d5 (S)			10	130
3	Terphenyl-d14 (S)			36	140

it/cf

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for PCBs by 8082 in Water

		5/17/2010	6/15/2009	LCS/LCSD 8/23/2010			MS/MSD 8/23/10			DUP
#	Analyte	MDL (ug/L)	PQL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	PCB, Total	0.30262	1.0	65	130	20	52	130	20	
2	PCB-1016 (Aroclor 1016)	0.30262	1.0	65	130	20	52	130	20	
3	PCB-1221 (Aroclor 1221)	0.30262	1.0	65	130	20	52	130	20	
4	PCB-1232 (Aroclor 1232)	0.30262	1.0	65	130	20	52	130	20	
5	PCB-1242 (Aroclor 1242)	0.30262	1.0	65	130	20	52	130	20	
6	PCB-1248 (Aroclor 1248)	0.30262	1.0	65	130	20	52	130	20	
7	PCB-1254 (Aroclor 1254)	0.30262	1.0	65	130	20	52	130	20	
8	PCB-1260 (Aroclor 1260)	0.30262	1.0	65	130	20	52	130	20	
9	PCB-1262 (Aroclor 1262)	0.30262	1.0	65	130	20	52	130	20	
10	PCB-1268 (Aroclor 1268)	0.30262	1.0	65	130	20	52	130	20	

#	Surrogates 08/23/10									
1	Decachlorobiphenyl (S)			31	148					
2	Tetrachloro-m-xylene (S)			16	147					

mx/cf

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc
Method Detection Limits and Reporting Limits
for Pesticides by EPA 8081 in Water

		1/1/2007	1/1/2007	LCS/LCSD 8/23/2010			MS/MSD 8/23/2010			DUP
#	Analyte	MDL (ug/L)	PQL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	2,4'-DDD	0.0083	0.05	70	130	20	70	130	20	
2	2,4'-DDE	0.0180	0.05	70	130	20	70	130	20	
3	2,4'-DDT	0.0098	0.05	70	130	20	70	130	20	
4	4,4'-DDD	0.0230	0.10	67	130	20	67	130	20	
5	4,4'-DDE	0.0230	0.10	56	133	20	56	133	20	
6	4,4'-DDT	0.0260	0.10	53	130	20	53	130	20	
7	Aldrin	0.0120	0.05	53	130	20	53	130	20	
8	Chlordane (Technical)	0.1800	1.00	70	130	20	70	130	20	
9	Chlorpyrifos	0.0500	0.05	70	130	20	70	130	20	
10	Dieldrin	0.0180	0.10	70	130	20	10	171	20	
11	Endosulfan I	0.0110	0.05	58	130	20	55	130	20	
12	Endosulfan II	0.0230	0.10	70	130	20	70	130	20	
13	Endosulfan sulfate	0.0170	0.10	67	130	20	67	130	20	
14	Endrin	0.0240	0.10	66	130	20	66	132	20	
15	Endrin aldehyde	0.0190	0.10	42	132	20	42	132	20	
16	Endrin ketone	0.0160	0.10	70	130	20	70	130	20	
17	Heptachlor	0.0091	0.05	61	130	20	50	130	20	
18	Heptachlor epoxide	0.0084	0.05	69	130	20	68	130	20	
19	Hexachlorobenzene	0.0088	0.05	70	130	20	70	130	20	
20	Methoxychlor	0.0890	0.50	59	130	20	42	133	20	
21	Mirex	0.0092	0.05	70	130	20	70	130	20	
22	Oxychlordane	0.0094	0.05	70	130	20	70	130	20	
23	Pentachloroanisole	0.0098	0.05	70	130	20	70	130	20	
24	Toxaphene	0.4900	3.00	70	130	20	70	130	20	
25	alpha-BHC	0.0062	0.05	66	130	20	66	130	20	
26	alpha-Chlordane	0.0100	0.05	70	130	20	70	130	20	
27	beta-BHC	0.0130	0.05	70	130	20	70	130	20	
28	cis-Nonachlor	0.0150	0.05	70	130	20	70	130	20	
29	delta-BHC	0.0093	0.05	31	152	20	31	152	20	
30	gamma-BHC (Lindane)	0.0080	0.05	62	130	20	43	141	20	
31	gamma-Chlordane	0.0130	0.05	65	130	20	10	167	20	
32	trans-Nonachlor	0.0160	0.05	70	130	20	70	130	20	
33	Chlorinated Camphenes	22.526	100.00	63	130	20	63	130	20	

#	Surrogate 8/23/10									
1	Decachlorobiphenyl (S)			17	144					
2	Tetrachloro-m-xylene (S)			26	130					

iz/-

iz & 16 / cf

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Analyte	Soils		Tissues		Waters		Wipes		Control limits		
	MDL (ng/Kg)	PRL (ng/Kg)	MDL (ng/Kg)	PRL (ng/Kg)	MDL (pg/L)	PRL (pg/L)	MDL (ng/m2)	PRL (ng/m2)	Lower	Upper	RPD
2,3,7,8-TCDF	0.32	1.0	0.17	1.0	1.5	10	0.27	1.0	67	158	20
2,3,7,8-TCDD	0.20	1.0	0.24	1.0	1.8	10	0.23	1.0	75	158	20
1,2,3,7,8-PeCDF	0.52	5.0	0.18	5.0	2.4	50	0.26	5.0	70	142	20
2,3,4,7,8-PeCDF	0.56	5.0	0.23	5.0	2.4	50	0.24	5.0	80	134	20
1,2,3,7,8-PeCDD	0.59	5.0	0.18	5.0	1.9	50	0.25	5.0	68	160	20
1,2,3,4,7,8-HxCDF	0.42	5.0	0.19	5.0	1.9	50	0.3	5.0	70	164	20
1,2,3,6,7,8-HxCDF	0.29	5.0	0.19	5.0	2.5	50	0.45	5.0	76	134	20
2,3,4,6,7,8-HxCDF	0.60	5.0	0.14	5.0	3.0	50	0.49	5.0	64	162	20
1,2,3,7,8,9-HxCDF	0.85	5.0	0.20	5.0	4.2	50	0.35	5.0	72	134	20
1,2,3,4,7,8-HxCDD	0.59	5.0	0.43	5.0	4.8	50	0.33	5.0	84	130	20
1,2,3,6,7,8-HxCDD	0.43	5.0	0.18	5.0	3.8	50	0.33	5.0	78	130	20
1,2,3,7,8,9-HxCDD	0.74	5.0	0.28	5.0	2.7	50	0.39	5.0	70	156	20
1,2,3,4,6,7,8-HpCDF	0.43	5.0	0.38	5.0	3.6	50	0.53	5.0	70	140	20
1,2,3,4,7,8,9-HpCDF	0.57	5.0	0.30	5.0	3.9	50	0.52	5.0	82	122	20
1,2,3,4,6,7,8-HpCDD	0.59	5.0	0.33	5.0	4.8	50	0.64	5.0	78	138	20
OCDF	0.91	10.0	0.67	10.0	4.3	100	1.28	10.0	78	144	20
OCDD	2.1	10.0	0.84	10.0	13.4	100	1.79	10.0	63	170	20

Pace Analytical Services, Inc
Method Detection Limits and Reporting Limits
for Metals by EPA 6020 in Water

		7/19/2010	4/27/2009	LCS/LCSD 1/19/09			MS/MSD 1/19/09			DUP
#	Analyte	MDL (ug/L)	PQL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	Aluminum	5.042	250.00	80	120	20	75	125	20	
2	Antimony	0.134	1.00	80	120	20	75	125	20	
3	Arsenic	0.253	1.00	80	120	20	75	125	20	
4	Barium	0.265	1.00	80	120	20	75	125	20	
5	Beryllium	0.292	1.00	80	120	20	75	125	20	
6	Boron	1.375	20.00	80	120	20	75	125	20	
7	Cadmium	0.167	1.00	80	120	20	75	125	20	
8	Calcium	30.249	250.00	80	120	20	75	125	20	
9	Chromium	0.2590	1.00	80	120	20	75	125	20	
10	Cobalt	0.138	1.00	80	120	20	75	125	20	
11	Copper	0.329	1.00	80	120	20	75	125	20	
12	Iron	7.844	250.00	80	120	20	75	125	20	
13	Lead	0.290	1.00	80	120	20	75	125	20	
14	Lithium	0.187	1.00	80	120	20	75	125	20	
15	Magnesium	8.363	250.00	80	120	20	75	125	20	
16	Manganese	0.358	1.00	80	120	20	75	125	20	
17	Mercury	0.043	0.20	80	120	20	75	125	20	
18	Molybdenum	0.228	1.00	80	120	20	75	125	20	
19	Nickel	0.296	1.00	80	120	20	75	125	20	
20	Phosphorus	19.299	50.00	80	120	20	75	125	20	
21	Potassium	39.614	250.00	80	120	20	75	125	20	
22	Selenium	0.348	1.00	80	120	20	75	125	20	
23	Silicon	17.235	50.00	80	120	20	75	125	20	
24	Silver	0.127	0.50	80	120	20	75	125	20	
25	Sodium	12.545	250.00	80	120	20	75	125	20	
26	Strontium	0.255	1.00	80	120	20	75	125	20	
27	Thallium	0.387	1.00	80	120	20	75	125	20	
28	Tin	0.145	10.00	80	120	20	75	125	20	
29	Titanium	0.343	1.00	80	120	20	75	125	20	
30	Total Hardness		5.00	80	120	20	75	125	20	
31	Uranium-238	0.025	1.00	80	120	20	75	125	20	

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc
Method Detection Limits and Reporting Limits
for Metals by EPA 6020 in Water

32	Vanadium	0.378	1.00	80	120	20	75	125	20	
33	Zinc	1.520	10.00	80	120	20	75	125	20	
34	Zirconium	0.159	1.00	80	120	20	75	125	20	

pt/-

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

920-469-2436
www.pacelabs.com

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for Alkilinity by EPA 310.2 and SM2320B

	EPA 310.2	5/28/2009	1/30/2007	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	Total Alkalinity	10.00	20.0	90	110	20	90	110	20	20
2	Dissolved Alkalinity	10.00	20.0	90	110	20	90	110	20	20

	SM2320B	5/25/2009	1/30/2007	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	Alkalinity, Bicarbonate	1.80	10.0	80	120	20	80	120	20	20
2	Alkalinity, Carbonate	1.80	10.0	80	120	20	80	120	20	20
3	Alkalinity, Hydroxide	1.80	10.0	80	120	20	80	120	20	20
4	Alkalinity, Total as CaCO3	1.80	10.0	80	120	20	80	120	20	20
5	Alkalinity, Phenolphthalein	1.80	10.0	80	120	20	80	120	20	20

mh,th

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for I.C. Anions in Water by EPA 300.0

		8/31/2009	8/31/2009	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	Br	0.20	0.4	90	110	20	90	110	20	20
2	Cl	2.00	4.0	90	110	20	90	110	20	20
3	F	0.20	0.4	90	110	20	90	110	20	20
4	SO4	2.00	4.0	90	110	20	90	110	20	20
5	NO2	0.10	0.2	90	110	20	90	110	20	20
6	NO3	0.20	0.4	90	110	20	90	110	20	20
7	N/N	0.20	0.4	90	110	20	90	110	20	20

fb

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for Nitrogen and Nitrite by EPA 353.2

		5/25/2009	1/30/2007	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	N+N	0.125	0.25	90	110	20	90	110	20	20

bf

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for Ammonia in Water by EPA 350.1

		5/25/2009	5/25/2009	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	NH3	0.250	0.500	90	110	20	90	110	20	20
2	NH3, distilled	0.250	0.500	90	110	20	90	110	20	20
3	NH3, distilled, dissolved	0.250	0.500	90	110	20	90	110	20	20
4	NH4	0.265	0.530	90	110	20	90	110	20	20
5	NH4, distilled	0.265	0.530	90	110	20	90	110	20	20
6	NH4, distilled, dissolved	0.265	0.530	90	110	20	90	110	20	20

	40WTA9 Smartchem	2/3/2010	2/3/2010	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	NH3, distilled, dissolved	0.200	0.400	90	110	20	90	110	20	20
2	NH3, distilled	0.200	0.400	90	110	20	90	110	20	20
3	NH4, distilled, dissolved	0.212	0.424	90	110	20	90	110	20	20
4	NH4, distilled	0.212	0.424	90	110	20	90	110	20	20

VZ

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for Total Cyanide in Water by EPA 335.4

	40WTA2 Lachat	5/25/2009	4/16/2007	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	CN	0.00800	0.02	90	110	20	90	110	20	20

	40WTA9 Smartchem	1/20/2010	4/16/2007	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
2	CN	0.00612	0.02	90	110	20	90	110	20	20

gr

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for Total Solids by EPA 160.1,160.2,and 160.3

Method: 2540C		5/25/2009	1/30/2007	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	Total Dissolved Solids	4.34	10.0	80	120	20	80	120	20	20

tc

Method: 2540D		5/25/2009	1/30/2007	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	Total Suspended Solids	1.54	10.0	80	120	20	80	120	20	20

td

Method: 2540B		4/16/2007	4/16/2007	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	Total Solids	4.23	10.0	80	120	20	80	120	20	20

gz

Pace Analytical Services, Inc.
1241 Bellevue St., Suite 9
Green Bay, WI 54302

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for Total Phosphorus in Water by EPA 365.4

	40WTA9 Smartchem	7/30/2009	7/30/2009	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	Phosphorus	0.20	0.4	90	110	20	90	110	20	20

dh

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for Hexavalent Chromium by SM3500 Cr-D

		5/25/2009	1/30/2007	LCS/LCSD			MS/MSD			DUP
#	Analyte	True MDL (mg/L)	PQL (mg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1	Chromium, Hexavalent	0.0034	0.02	90	110	20	90	110	20	20

#	Surrogate									

pd

TABLE 4: INORGANIC COMPOUND LIST
SUMMARY OF LABORATORY LIMITS OF DETECTION AND CONTROL LIMITS
PACE ANALYTICAL SERVICES, INC - GREEN BAY LABORATORY

Parameter	Matrix	Prep Method	Analytical Method	MDL	EQL	Units	LCS Recovery LCL	LCS Recovery UCL	LCS RPDL	MS Recovery LCL	MS Recovery UCL	MSRPDL	CAS Number
Alkalinity, Total as CaCO3	Water	SM 2320B	SM 2320B	1.8	10	mg/L	80	120	20	80	120	20	
Cyanide	Water	EPA 335.4	EPA 335.4	0.00612	0.02	mg/L	90	110	20	90	110	20	57-12-5
Nitrate	Water	EPA 300.0	EPA 300.0	0.2	0.4	mg/L	90	110	20	90	110	20	14797-55-8
Nitrate plus Nitrite	Water	EPA 353.2	EPA 353.2	0.125	0.25	mg/L	90	110	20	90	110	20	
Sulfate	Water	EPA 300.0	EPA 300.0	2	4	mg/L	90	110	20	90	110	20	14808-79-8
Chloride	Water	EPA 300.0	EPA 300.0	2	4	mg/L	90	110	20	90	110	20	16887-00-6

NOTES:

Actual sample reporting limits for soils are on a dry weight basis and will be higher than the values listed due to moisture content and the volume of soil sample.
Soil samples may be diluted due to the presence of high levels of target and non-target analytes, or other matrix interferences.
Laboratory MDLs and Control Limits are subject to change.

Table 4: BFB Key Ions and Abundance Criteria

m/e	ION ABUNDANCE CRITERIA
95	Base Peak, 100% relative abundance
50	15.00 - 40.00% of mass 95
75	30.00 - 80.00% of mass 95
96	5.00 - 9.00% of mass 95
173	Less than 2.00% of mass 174
174	50.00 - 120.00% of mass 95
175	5.00 - 9.00% of mass 174
176	95.00 - 101.00% of mass 174
177	5.00 - 9.00% of mass 176

Table 5: Control Limits for Accuracy (%R) and Precision (RPD)

Compound	Lower % Recovery	Upper % Recovery	RPD %
1,4-Dioxane (RL LFB)	50	150	
1,4-Dioxane (Mid – high LFB)	70	130	
1,4-Dioxane (FLSM/D)	70	130	30
Surrogate			
1,4-Dioxane-d8	70	130	

Test: VOC 8260 Low Level

Method: EPA 8260B

Matrix: GROUND WATER

ANALYTE	CAS #	DL	LOQ/ PQL	REPORTING LIMIT	UNITS	LCS LOWER	LCS UPPER	MS LOWER	MS UPPER	RPD
Vinyl chloride	75-01-4	0.010	0.032	0.010	ug/L	70	137	67	170	20